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Compressed Air Magazine

OLD FRAME FOR A NEW TERMINAL IN PHILADELPHIA

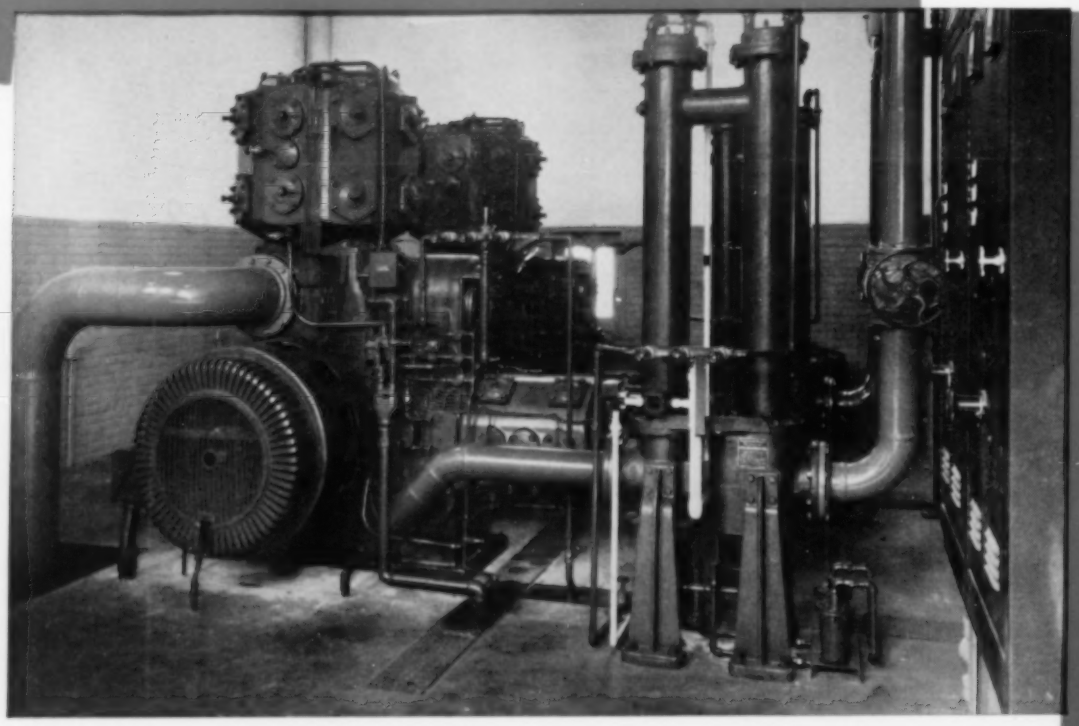
View from Historic Broad Street Station While It Was Being Razed

(SEE INDEX PAGE AND PAGE 104)

VOLUME 58 • NUMBER 4

NEW YORK • LONDON

How the RIGHT COMPRESSOR OIL is selected



WHEN YOU CALL IN a Texaco Lubrication Engineer to advise you on air compressor lubrication, he studies first of all the particular conditions under which your compressors operate. He knows that no *one* oil can satisfactorily meet *every* condition. He also knows the *complete line* of Texaco air compressor oils — *one* of which will be exactly right for your compressors, whatever their type or whatever the conditions of operation.

Texaco matches the oil to the operating conditions. That's why compressors lubricated with Texaco air compressor oils stay so clean and efficient. That's why Texaco-lubricated compressors cost less to run.

Let a Texaco Lubrication Engineer help you get better compressor performance. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Air Compressor Oils

FOR ALL OPERATING CONDITIONS

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE, on television Tuesday nights. METROPOLITAN OPERA radio broadcasts Saturday afternoons

NEW

SEND FOR THIS BULLETIN 210 TODAY

STAYNEW
PIPE LINE FILTERS
DESIGNED FOR LOW PRESSURES UP TO 40 psi
DOLLINGER CORPORATION, 11 Centre Pk., Rochester 3, New York

Get All the Facts!

BULLETIN 210 CONTAINS

- DETAILED CUTAWAY DRAWINGS
- DESCRIPTION OF CLEANING ACTIONS
- CHARTS OF CAPACITIES, RESISTANCE, SIZES and WEIGHTS
- TYPES OF FILTERING MEDIA AVAILABLE
- EXCLUSIVE CONSTRUCTION FEATURES FOR THE ORIGINAL EQUIPMENT MARKET

Representatives in Principal Cities

DOLLINGER

CORPORATION

7 Centre Park, Rochester 3, New York

DOLLINGER PROTECTS MOTOR STAYNEW FILTERS

TO AVOID AIR LINE TROUBLES

...Use the know-how of your HANSEN Representative

THE HANSEN REPRESENTATIVE—

Quick-Connective Couplings Are His Business

BUT SO ARE AIR LINE PROBLEMS

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The main job of the Hansen representative is to supply you with exactly the right couplings for your particular requirements—where quick connection and disconnection will save you time and money.

There are, however, hundreds of plants that regularly make use of his experience to improve the overall performance of their fluid line circuits. Frequently when trouble arises, he can make suggestions which will effectively correct your difficulties.

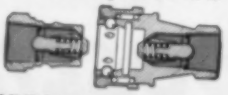
From years of experience in close contact with many types of hook-ups, both large and small, he can advise you on how to make pipe connections for proper take-off, how much and in what direction to pitch your lines, and where and how to install drains—all designed to give you more efficient, trouble-free performance of your air-operated devices.

QUICK-CONNECTIVE FLUID LINE COUPLINGS

1. QUICK CONNECTION AND DISCONNECTION
2. INSTANT AUTOMATIC FLOW OR SHUT-OFF

One-Way Shut-Off

Two-Way Shut-Off



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Send for Catalog!

THE HANSEN MANUFACTURING COMPANY

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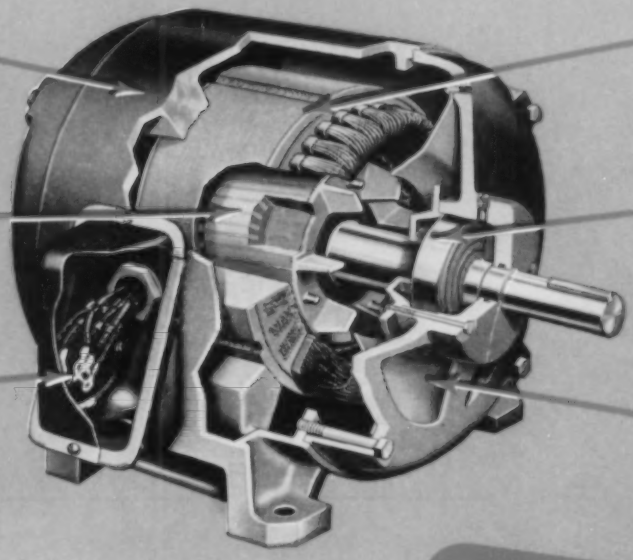
Look for These 6 Signs of Good Motor Design



1

FRAME — Rigid cast iron. Designed to hold bearing alignment, resist corrosion, prevent distortion under any normal operating condition.

2

ROTOR — Die cast aluminum for maximum strength. Practically indestructible in service.

3

CONDUIT BOX — Provides plenty of room to connect leads. Adjustable to any position. Long leads make connection easy.

4

STATOR — Multiple-dipped, baked after every dip. Builds up tough protection against heat, moisture, corrosion.

5

BEARINGS — Double shielded with provision for in-service lubrication if desired. Will run for long periods without attention but can be greased if conditions demand it. Thoroughly protected against outside dirt.

6

VENTILATION — Drip-proof with plenty of internal air circulation to prevent hot spots.

Get Allis-Chalmers Motors for these Extra Values!

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Certified Service — Nearly 100 Allis-Chalmers Certified Service Shops provide factory-approved parts and service on your Allis-Chalmers motors. Screened for modern equipment, adequate experience and business integrity, these independently owned service shops will provide you with prompt, economical repair and maintenance.

Complete Drives from One Source — Allis-Chalmers can supply your complete drive — motor, control and *Texrope* V-belt drive — from one convenient, reliable source.

Application Engineering — Your Allis-Chalmers District Office representative or Authorized Dealer will be glad to help you select exactly the right motors for your needs. For additional information, write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B6052. A-3954

Texrope is an Allis-Chalmers trademark.

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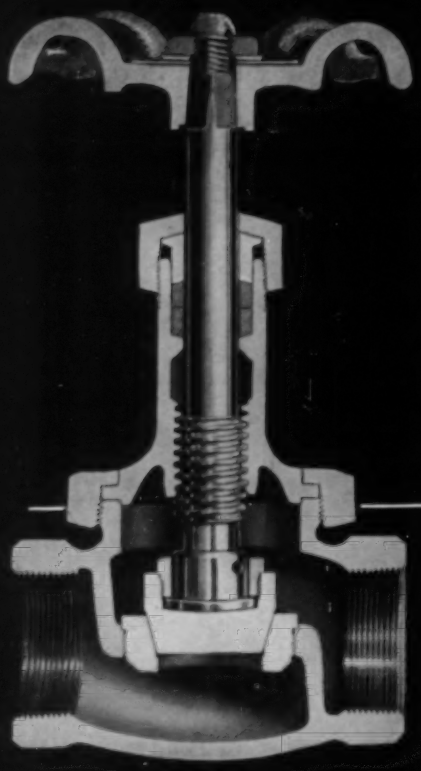
by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS



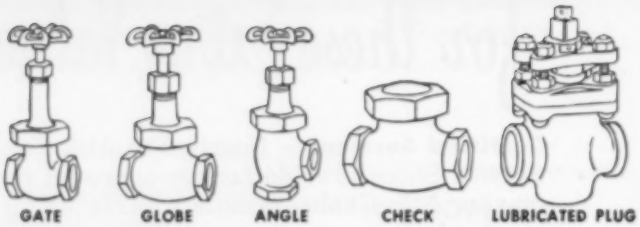
BRONZE

COMPLETE LINES OF BRONZE VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of types, pressure ratings, sizes, and patterns, including Walseal® Bronze Valves and Fittings for making Silbraz® joints.

Walworth also manufactures complete lines of valves and fittings – including Lubricated Plug Valves – made of steel, iron, and special alloys as well as bronze.

Walworth-made valves, pipe fittings, and pipe wrenches, total approximately 50,000 items–all sold through distributors in principal centers throughout the world.

Walworth engineers will be glad to help you with your problems. For full information call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.



Bronze valves in gate, globe, angle, check, and lubricated plug types are manufactured by Walworth. Illustrated is a sectional view of a Walworth No. 225P Bronze Globe Valve. This valve has a working steam pressure rating of 350 psi at 550F (1,000 psi non-shock cold water, oil, and gas pressure). It features a renewable, plug type, stainless steel seat and disc, heat treated to 500 Brinell hardness.

WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

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EIMCO'S
"AT HOME" UNDERGROUND

Small and large mining companies have found that Eimco loaders are best. They cost less to maintain, they're faster, more efficient and the operators prefer to run them.

Eimco's, have a number of other advantages. They were designed to be "at home" underground. In tunnels where going is tough you'll find Eimco's more dependable. In mines where production by drawhole mining is practical you'll find Eimco's more economical. In the Uranium country, when its often desirable to sink an incline to the level of the ore body, you'll find Eimco's the only choice as they're as much at home on a slope as they are in level mining.

Write for more information on versatile Eimco loaders.

Eimco 12B Loader operating on slope and (below) operating on level ground in Uranium mine.

At right — Eimco 12B — Smallest mechanical loader — Economical, fast and versatile.

EIMCO A436

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

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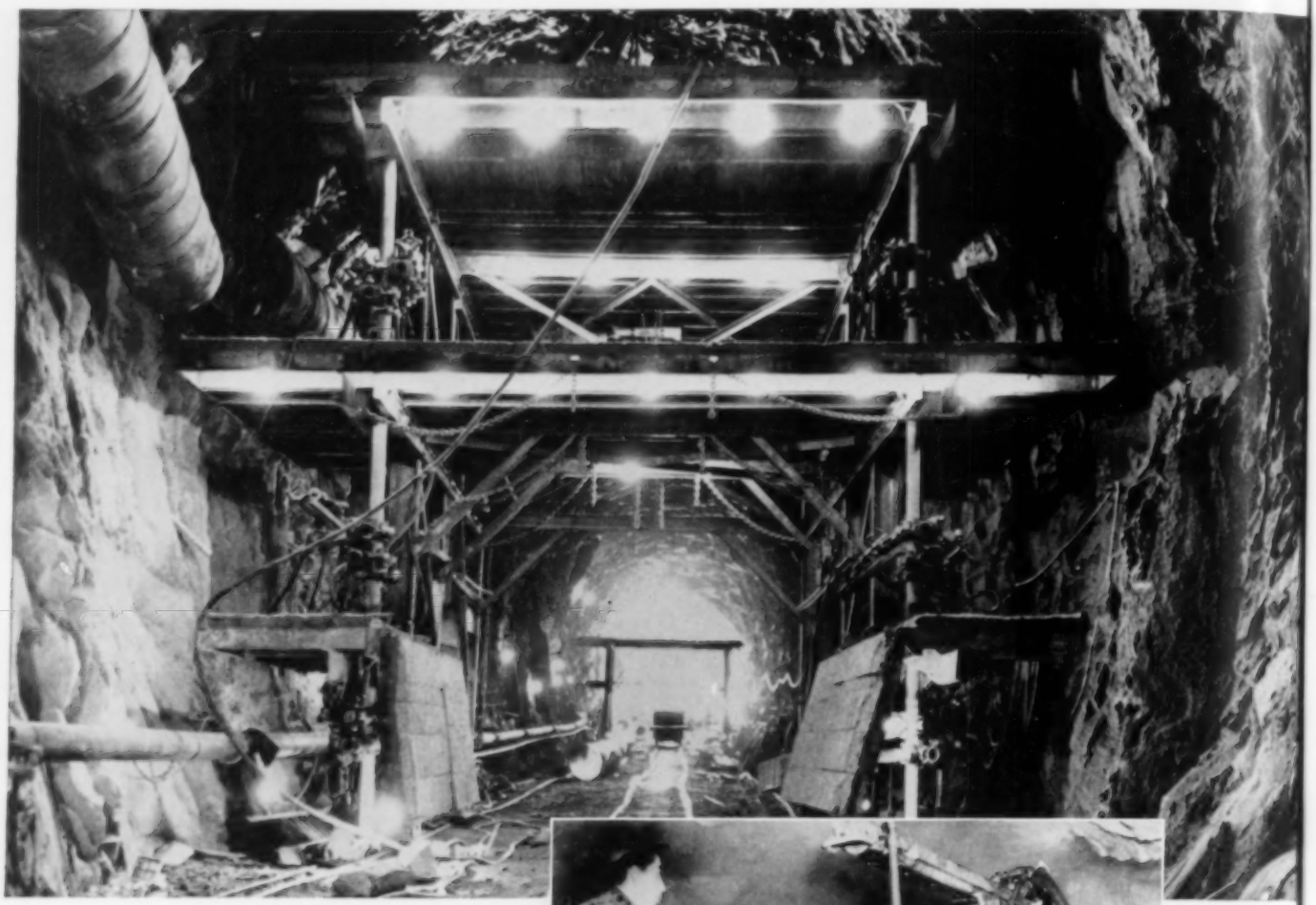
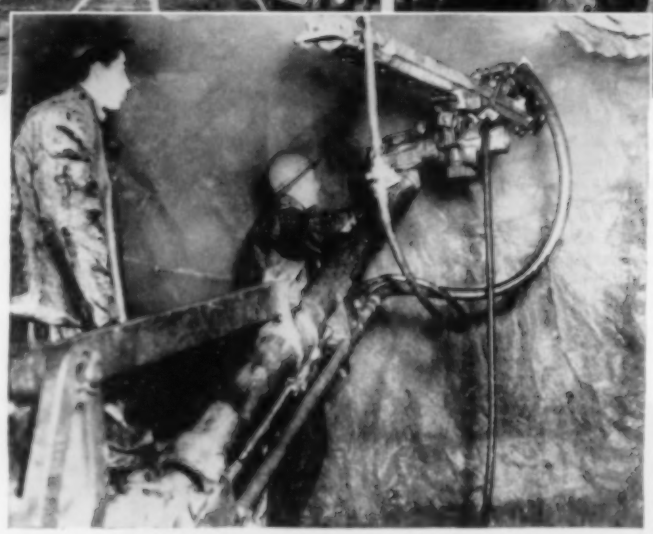
World's Tunneling Record



Front end of the 3-deck drilling jumbo pulled back from the Kemano heading of the power tunnel while mucking was in progress. This carriage mounts a total of fifteen Ingersoll-Rand DA-35 power-feed 3½-inch Drifters.



Here, one of the Boom-Jumbo mounted DA-35 drifters on the top deck of the drill carriage, is putting in a top hole.

OTHER FAMOUS JOBS WHERE WORLD TUNNEL RECORDS WERE MADE WITH INGERSOLL-RAND DRILLS

1921 Hetch Hetchy Project
1922 Big Creek Project
1932 Hoover Dam
1940 Carlton Tunnel
1940 Delaware Aqueduct
1944 Alva B. Adams Tunnel
1948 Rock Creek Bore
1949 Big Creek Dam
1950 Owens Gorge

broken **FOUR TIMES** on Alcan B. C. Project

Ingersoll-Rand Drifters and Carset Bits in 25′ Heading set new world's records of 248, 258, and 261 feet in six days

...then raised it to 274 ft.!

Analysis of drilling –

Total footage for week (6 days)	274
Total volume or rock in place (cu. yds.)	6165
Number DA-35 drills on Jumbo	15
Number of holes drilled each round	96
Number of rounds drilled	27
Average daily advance (feet)	45.67
Average advance per round (feet)	10.15
Average cu. yds. of rock removed per round	228.6
Average drilling time per round	1 hr. 24 min.
Average footage drilled per round	1132

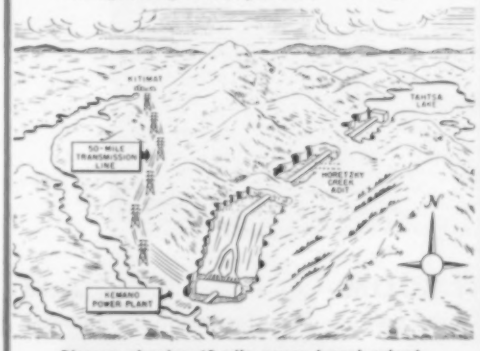


Diagram showing 10-mile power tunnel extending from Tahtsa Lake to underground power plant on Kemano River. Water will drop 2600 feet through penstocks to generate electric power for the aluminum smelter at Kitimat 50 miles distant.

ANOTHER world tunneling record has been broken – not once, but *four times* on the same job!

During the week ending September 29th, 1952, Canadian drilling crews of the Morrison-Knudsen Company of Canada, Limited, drove 248 feet of 25-foot diameter horseshoe bore in six days at the Kemano heading. This eclipsed the previous record of 241 feet of 24′ tunnel, made by M-K tunnelers at the Big Creek Number 4 dam in California in 1949.

In October and November the Kemano crews shattered their own records by driving 258 feet, then 261 feet in six day periods.

For the six day week ending November 29th the Alcan aces topped their previous footage by driving 274 feet at the Horetzky-Tahtsa heading at the midway point of the tunnel.

These world records for tunneling speed were all made with Ingersoll-Rand DA-35 Power Feed Drifters with 48″ aluminum shells, using 1¼ lugged round steel and 2″ Carset Jackbits.

The ten mile bore in British Columbia will carry water from the impounded Tahtsa Lake area through the Coast Range mountains to the huge Kemano underground power plant. It is part of the half-billion-dollar "Alcan" Project of the Aluminum Company of Canada, Limited, that will add tremendously to the economic production and wealth of North America.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

860-5

ROCK DRILLS • COMPRESSORS • AIR TOOLS • CENTRIFUGAL PUMPS • TURBO BLOWERS • CONDENSERS • DIESEL AND GAS ENGINES

For Big Output on Big Jobs . . .

4 WAY FRONT-END *Superiority*

BUCYRUS-ERIE's extensive research and development work on walking draglines has always aimed at perfecting machines which combine maximum long term output with minimum maintenance costs. One of the most significant evidences of its success is advanced front-end design — which assures the durability you need without sacrificing range, speed or capacity. Check these advantages:

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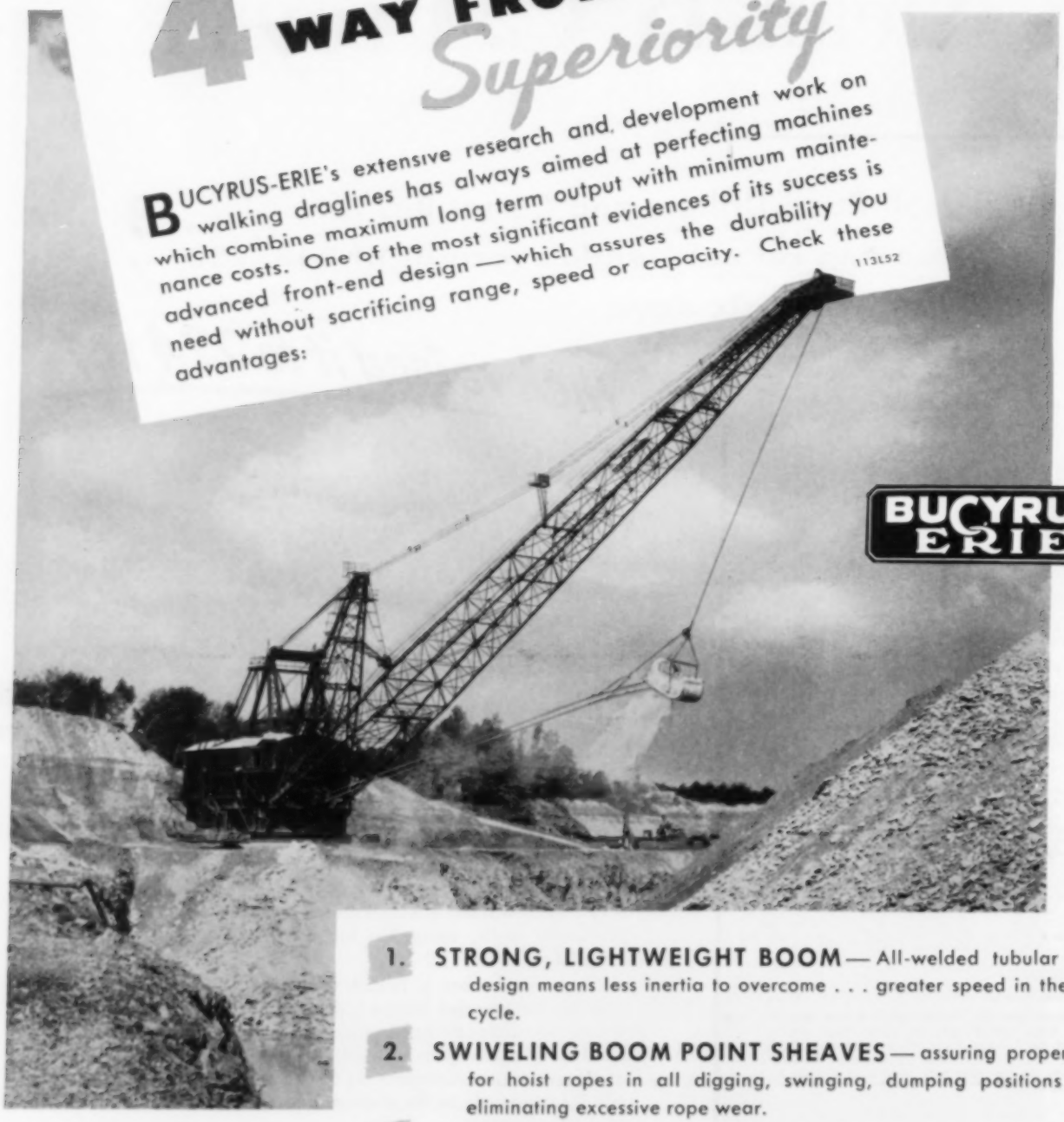


● Bucyrus-Erie 650-B walking dragline stripping overburden in a limestone quarry shows unique front-end design which has made it a standout for stripping operations.

1. **STRONG, LIGHTWEIGHT BOOM** — All-welded tubular laced design means less inertia to overcome . . . greater speed in the work cycle.

2. **SWIVELING BOOM POINT SHEAVES** — assuring proper lead for hoist ropes in all digging, swinging, dumping positions . . . eliminating excessive rope wear.

3. **TWIN DRAG ROPES ON LARGER SIZES**—keep bucket stable throughout digging . . . aid in fast filling; also allow use of smaller size cable for better rope-sheave ratios, longer rope life.

4. **OUTSTANDING FRONT-END BALANCE** — Each different length boom is so accurately balanced with the rest of the dragline and with the correct size bucket that high output can be sustained not just for a matter of days . . . but month-after-month, year-after-year.

BUCYRUS-ERIE CO., South Milwaukee, Wisconsin

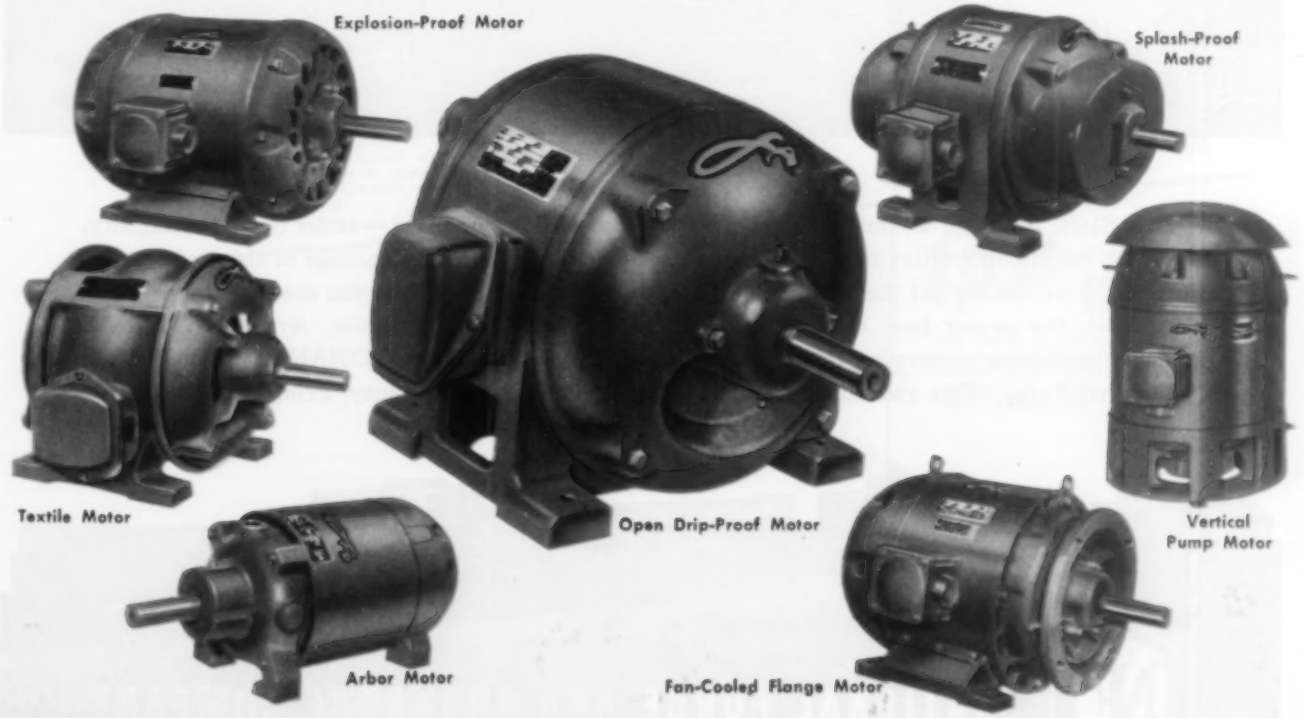
. . . the mark of an outstanding motor

The familiar L. A. that identifies each motor built by The Louis Allis Co. is more than a mere trademark. These two distinctive strokes formed the signed initials of Louis Allis—our founder and first president. He used them to signify approval on the many matters that crossed his desk each day.

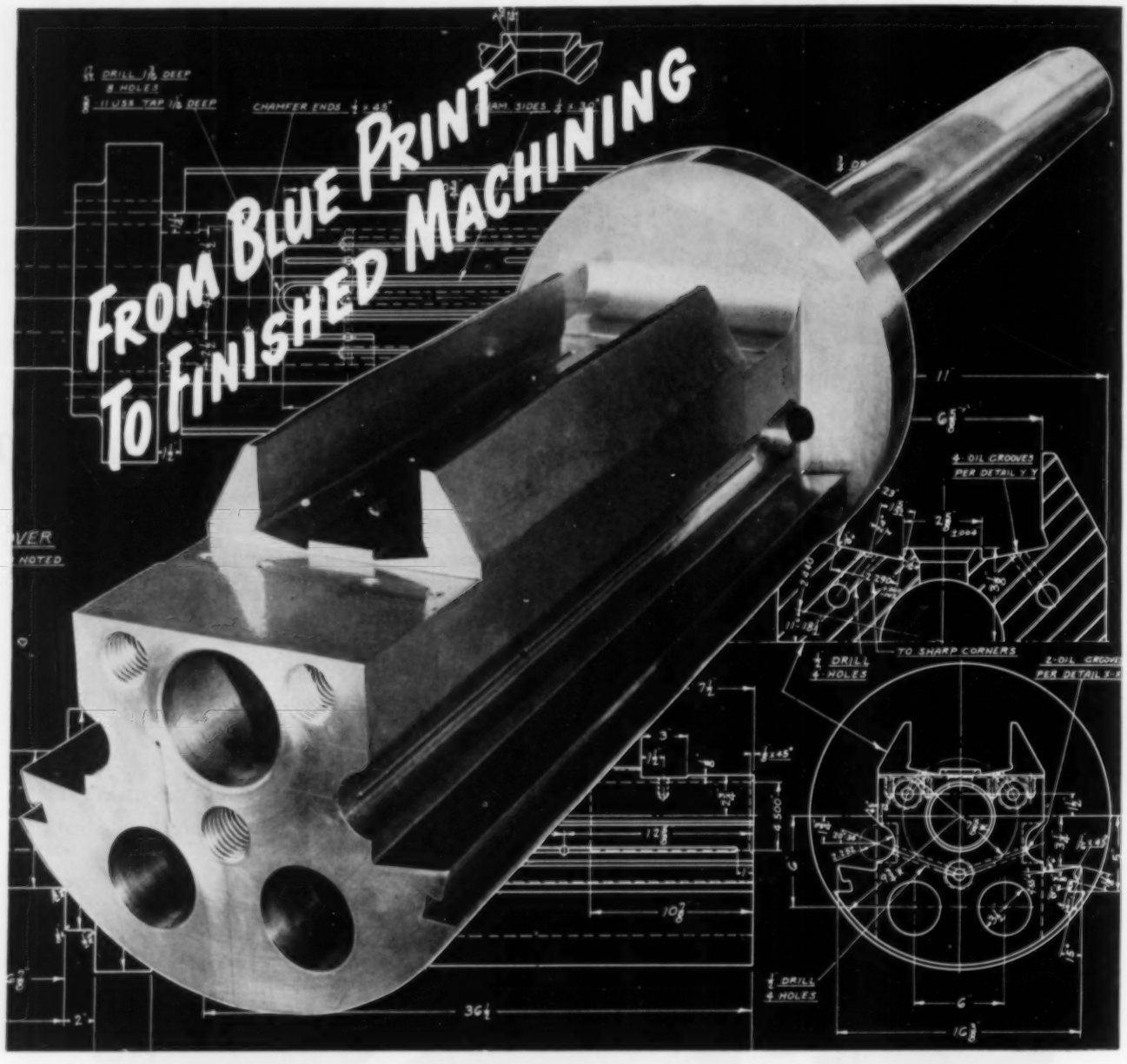
To us these initials on our product symbolize a challenge—a challenge to continue building our motors to the high standards of quality and performance established by Louis Allis more than 50 years ago. To you they mean sound design, rugged construction, and ample safety factor for long life and dependability—all the things you want in electric motors.

You can't go wrong when the motor for *your* job carries the famous L. A. Trade-mark. Always look for it.

IN101



THE LOUIS ALLIS CO. MILWAUKEE 7, WISCONSIN



This Block Body for a Tension Reel represents the coordinated effort of many National Forge skills in turning out the required electric alloy steel, the proper heat treating and the intricate machining to exacting tolerances.

National Forge offers you complete forging service in one plant—under one responsibility.

Why not take advantage of this "all-in-one" service the next time you need forgings?

For full information, write NATIONAL FORGE AND ORDNANCE COMPANY, Irvine, Warren County, Pennsylvania.

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This Size . . . . ➧

or This Size . . . . ➧

with all "kinds of sizes" in between

SKF's wide range of bearing types and sizes, plus helpful SKF engineering cooperation, makes it possible for you to select the bearing whose characteristics make it the best bearing choice for your particular application.

SELF-ALIGNING BALL BEARINGS

Compensate for angular misalignment resulting from faulty mounting, shaft deflection or distortion of the foundation. For radial loads and moderate thrust loads in either direction.

SPHERICAL ROLLER BEARINGS

Unexcelled for capacity. Inherently self-aligning. The full capacity of the bearing is always available for useful work. Will carry substantial thrust load in either direction.

DOUBLE-ROW DEEP GROOVE BALL BEARINGS

Embody the same design principle as the single-row type, but have lower axial displacement and substantial thrust capacity in either direction. Have very high radial capacity.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Sustain, in addition to radial load, substantial thrust load in either direction even at high speeds. Available with famous Fairprene Red Seals which keep dirt out and lubricant in. Also with any combination of Red Seals, shields, and snap-rings. Furnished in standard or precision tolerances.

ANGULAR CONTACT BALL BEARINGS

Support heavy thrust load in one direction, sometimes combined with moderate radial load. Can be mounted singly or in tandem for constant thrust load in one direction; also in pairs, face-to-face or back-to-back, for combined thrust and radial loads.

CYLINDRICAL ROLLER BEARINGS

Very high radial capacity and low friction which permits high-speed operation. Easy to dismount, even when both rings are mounted with a tight fit.

BALL THRUST BEARINGS

For pure thrust load in one direction only. Not self-aligning. The load line through the balls is parallel to the shaft axis, resulting in high thrust capacity and minimum axial deflection.

SPHERICAL ROLLER THRUST BEARINGS

For heavy thrust loads, or combined loads which are predominantly thrust, at high speeds on vertical or horizontal shafts. Fully self-aligning.

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BALL AND ROLLER BEARINGS

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– manufacturers of **SKF** *and* HESS-BRIGHT *bearings.*

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Here is a typical problem. . . . Ingersoll-Rand Air Motors solved this tough control problem in a paper mill. Since steam and acid conditions prevailed, manual operation of digester dump valves was extremely dangerous. These conditions also prevented satisfactory use of electric motors and controls. Size 55SM Air Motors were installed, dumping was controlled from the charging floor 50 feet above the dump valves, and stand-by valve crews were no longer necessary, due to the reliable, trouble-free operation of the Ingersoll-Rand Air Motors.

When wide ranges of operating speeds are desired . . . when instantaneous starting and stopping is needed . . . when the motor will be subjected to frequent stalling and overloads . . . when wet, acid, or explosive atmospheres, or high temperatures make operations too hazardous for direct manual control . . . when expensive and complicated protection devices would otherwise be required . . . when compact motor units are essential . . . and finally, when installation and maintenance costs must be kept low . . . the Ingersoll-Rand Air Motor is the answer to the problem.

Write, wire, or phone your nearest Ingersoll-Rand branch office for help with your tough control and drive problems . . . or request the new Air Motor Bulletin, Form 5072, which gives full information on over 110 sizes of Air Motors . . . both Piston and Multi-Vane types . . . speeds from 5400 to 19 r.p.m. . . . from 1 to 24 H.P. . . . or request information on fractional horsepower Air Motors.

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For maximum wire rope efficiency and economy, call your nearest Roebling office for a Field Man. He'll recommend the best ropes for your machines.

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GAIN High starting torque...
LOSE Maintenance Problems

WITH THESE NEW CAPACITOR MOTORS

Starting's no problem! Even on such heavy, single-phase jobs as refrigeration compressors, these new CAP motors come through with ample breakaway torque . . . require minimum maintenance!

CAP motors have simpler design! Gone are many parts which wear, break and corrode! Retained is all the power-packed stamina you demand! No brushes to replace or adjust. No intricate winding of rotor to cause electrical failure . . . no commutator to clean, turn down or undercut. Instead, the CAP includes such trouble-free features as:

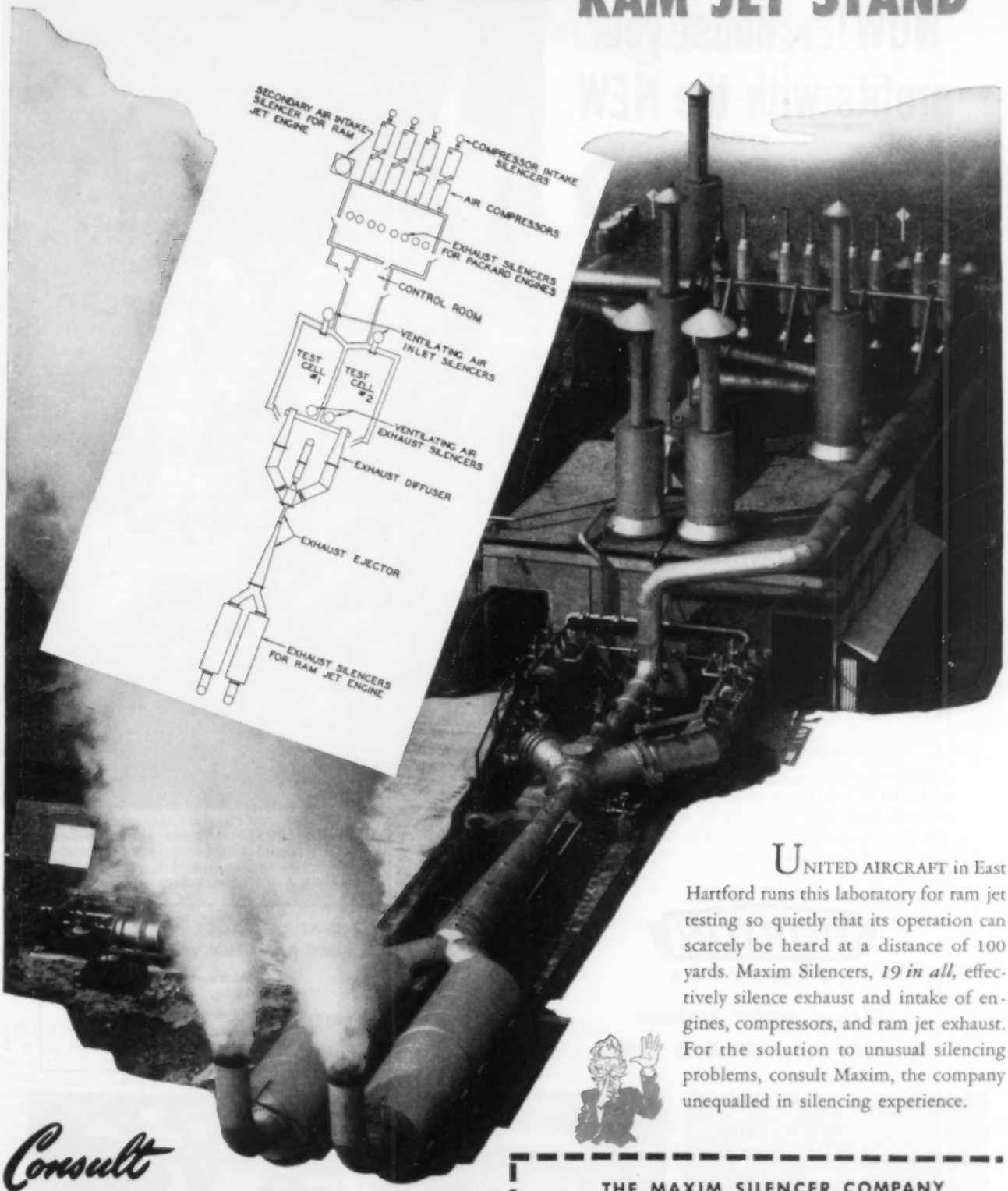
- Pre-lubricated, factory-sealed bearings—assure proper and permanent lubrication; grease sealed in—dirt sealed out.
- All-steel construction—provides high shock resistance; creates saving in weight and size of motor.
- Die-cast rotors—have no windings or brushes to cause trouble . . . are practically indestructible.

Learn all the many other advantages of these rugged motors. Ask your Westinghouse representative for a copy or write for the free booklet, B-5441, Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-21674-A

YOU CAN BE SURE...IF IT'S

Westinghouse

NINETEEN MAXIM SILENCERS ON THIS RAM JET STAND



UNITED AIRCRAFT in East Hartford runs this laboratory for ram jet testing so quietly that its operation can scarcely be heard at a distance of 100 yards. Maxim Silencers, *19 in all,* effectively silence exhaust and intake of engines, compressors, and ram jet exhaust. For the solution to unusual silencing problems, consult Maxim, the company unequalled in silencing experience.

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Norton's new, exclusive G Bond — the most efficient vitrified bond ever produced — is now ready.

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As a result, Norton ALUNDUM* grinding wheels made with the new G Bond have definite advantages that are *proved* in the more economical, more profitable work they do.

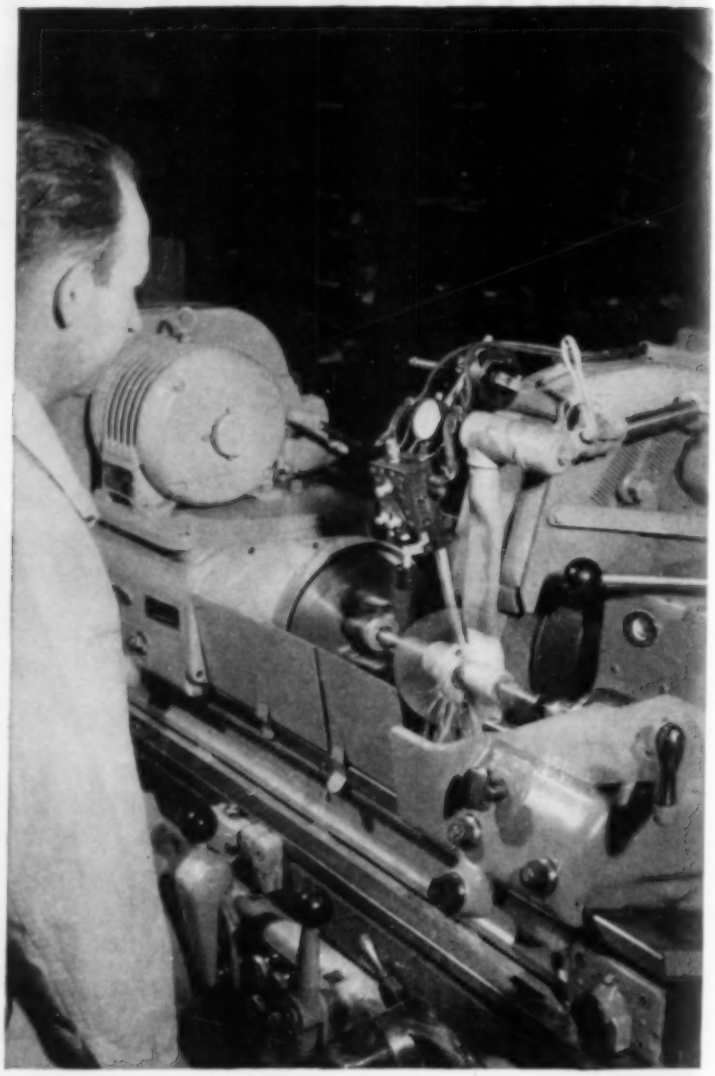
Make sure you add the new "Touch of Gold" to *your* grinding.

SEE YOUR NORTON DISTRIBUTOR

about arranging a test of one of the new G Bond ALUNDUM wheels in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

NORTON
ABRASIVES

Making better products to make other products better



THE "TOUCH OF GOLD" IS JOB-PROVED. The new Norton G Bond ALUNDUM wheels have been thoroughly field-tested in such types of grinding as cylindrical, centerless, surface, internal, gear, tool and cutter, form and thread grinding, and saw gumming.

7 BIG ADVANTAGES
Norton G Bond ALUNDUM wheels:

- Do more work per wheel
- Cut freer, cooler, faster
- Dress easier — more pieces per dressing
- Cover a wider range of jobs
- Hold shape — better for form grinding
- Hold corners better
- Ideal for crush dressing

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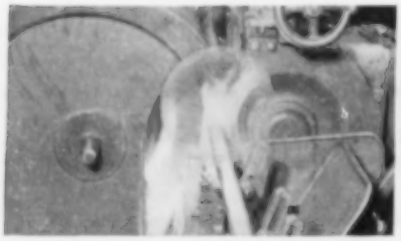

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ON THE COVER

OLD Broad Street Station in Philadelphia remained in service twenty years longer than it was supposed to. Its replacement, Broad Street Suburban, was completed in 1933, but the depression and then the war prevented making other changes essential to carrying out the midcity improvement plan. Finally, during the past year, wreckers went to work, and our cover picture was taken from the fourth floor of the 70-year-old depot as it was coming down. The latter frames the new Suburban Station, which has its terminal underground and is connected with City Hall and other nearby buildings by tunnels. From the street level up, the structure is occupied by Pennsylvania Railroad's general offices.

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IN THIS ISSUE

ALTHOUGH Akron, Ohio, is the pneumatic-tire capital, numerous other sections contribute importantly to the huge annual output of the circular rubber air cushions on which the nation rides. In a rural setting at Indiana, Pa., the McCreary Tire & Rubber Company has been doing that for 37 years. Our leading article describes its operations.

•

ARCHEOLOGISTS have their own special ways of digging—careful ways that go just so far and no farther. Excavating with them used to be strictly a manual operation, but means are gradually being found to mechanize some phases of it. Page 100.

•

BACK in 1886 about 450 trains steamed into and out of old Broad Street Station in Philadelphia every day. By last spring the number was down to 90, and three other stations were handling the bulk of the passengers. Consequently, after 28 years of planning and rearranging, it became possible to raze the structure and its unsightly elevated approach. Memories of the days when they were important links with the outside world are revived in the story of their passing. Page 104.

•

CORRECTIONS

FLORIDA isn't exactly mountainous, but it has higher spots than we gave it credit for in the description of our March front-cover picture. Our figure of 32 feet for its loftiest point should have had a "5" on the end of it. And as Colin K. Lee of Webster Groves, Mo., was quick to point out to us, the word "smithies" was incorrectly used in the heading *The Timekeeping Smithies of Nottingham*, page 77. A smithy is a working place and a smith is the man who works there.

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THE photographs reproduced with the article, *Shifting Nashville's Freight Yards* in our February issue (pages 48-49) were provided by Hurst Construction News, Nashville, Tenn.

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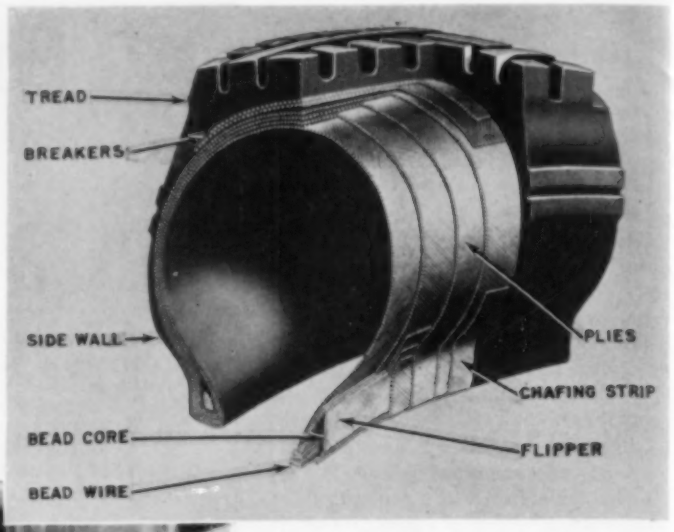
Tire Plant in the Country

McCreary Company Factory at Indiana, Pa., Is Small But Thoroughly Modern

J. C. Pierce



MAKE-UP OF TIRE
Cutaway illustration of a 4-ply tire with the various components designated.

TUCKED away from beaten paths and busy industrial centers in a peaceful farmside setting on the outskirts of Indiana, Pa., is the McCreary Tire & Rubber Company plant where big things are done in a small way. Founder Harry McCreary thought a tire factory in the midst of the western Pennsylvania coal fields would be a good business enterprise for the community and a needed stabilizer. More than 37 years of unbroken operation has proved that he was correct in his surmise. Surges in producing coal—the area's principal activity—are equalized by the

BIRTH OF A TIRE
In the opened mold of the steam-heated vulcanizing press at the left is a tire that has just been cured. Hanging from the conveyor are a "green" carcass (extreme left) as it looks when it comes from the tire-building machine and an expanded one (above the operator's head) in which an air bag has been inserted. McCreary makes tires of 102 type-and-size combinations, most of them for trucks and buses.

company's annual million-dollar payroll. The aim McCreary had set himself was not to make the most tires but to make the best. That guiding slogan has been held before the employees since the plant opened in May of 1915.

Being a small factory with a daily capacity of 600 tires doesn't prevent it from keeping pace with improvements in technique and equipment in the industry. In fact, it is modern in every respect and has a well-equipped research laboratory and an Akron standard-mold test wheel to maintain the position it has won in this highly competitive field. With its facilities and some 270 employees working three shifts, McCreary produces 102 different size-and-type combinations, with most of the output centered on truck and bus tires.

The matter of raw materials in tire manufacture is impressive. Many ingredients other than rubber and fabrics are needed to build today's rugged tires, and McCreary's receiving room is piled high with some 50 different kinds from near and far. The nature of these diverse products—clay, carbon black, zinc oxide, petrolatum, natural and synthetic rubber, sulphur, naphtha and stearic acid, to name only a few—denotes the extent to which tiremakers are dependent upon other industries and how important a part they play in the great American economic scheme.

Rubber-impregnated fabrics, beads and tread are the principal parts of a tire, and many painstaking operations are required before the raw materials that enter into them are ready for assembly. Rubber, textiles, chemical compounds and steel wire must be expertly combined so that the components can be shaped and transformed into modern tires. Precise control of temperature, pressure, ingredients and machinery is essential at every stage of the work, and in this service compressed air plays an important part. In fact, air under pressure has been intimately associated with tires since 1845 when England's Robert William Thompson conceived the idea of supporting vehicles on tubes cushioned with compressed air. Since then, although many substitutes have been tried, none approaches that medium in effectiveness. In the meantime, compressed air has become indispensable also in the manufacture of tires.

The rubber that goes into a tire at the McCreary plant may be either natural, synthetic or both. Natural rubber is received in 225-pound bales and is cut into sections about 4 inches thick and a foot square for ease of handling. Being tough, it is hard to cut by normal methods but parts neatly when forced by a motor-driven plunger against electrically heated knives. Synthetic rubber comes in 75-pound packaged slabs that can be fed into compounding machines without size reduction.

Proportioned quantities of rubber and other raw materials required to produce a tire that will meet rigid specifications go into a Size 11 Banbury mixer for what is known as mastication or milling, a process that was developed in the early nineteenth century by Thomas Hancock who found that rubber could be softened and plasticized by working it mechanically. The mixer contains two rotors that are driven by a motor through a speed reducer and that tear the rubber apart, squeeze and compress it into a soft, pliable mass. A Size 11 Banbury has a capacity of about 66.5 pounds per minute, as against 2.6 pounds in the case of a large-size open mill in which the material is fed into a narrow space between two rolls turning at different speeds in opposite directions.

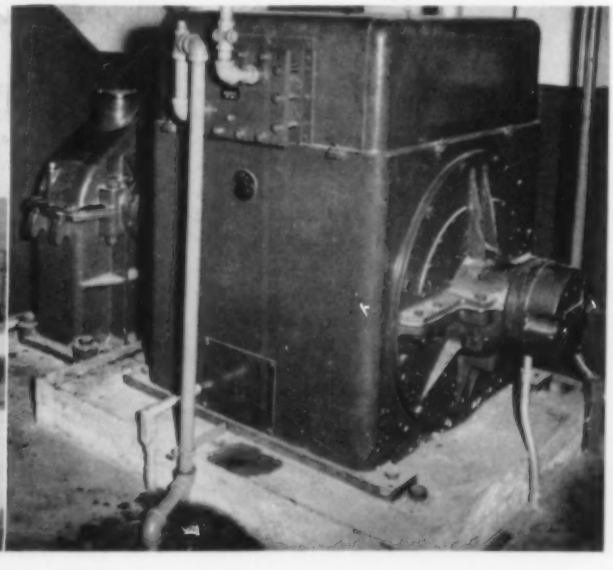
The ingredients which are added to rubber at this stage determine the physical characteristics of the finished stock and thus the part of the tire for which it will be used. Rubber specifications for tread, sidewall, etc., vary considerably. The additives are generally in a dry, powdered form and may include the reinforcing and filling pigments that give stiffness, strength and resistance to abrasion or to chemical action, as well as color pigments, softeners, and possibly some of the vulcanizing agents and accelerators, age resisters and special-purpose compounds.

The tiremaker is the principal industrial consumer of carbon black. In the early days that material served only to impart the black color, but then it was discovered that black tires were much more wear resistant than those without that ingredient. Now tire-tread rubber normally contains about 30 percent carbon black. But this angel of the tire manufacturer can also be a satan if not carefully controlled. It is used in the form of a superfine dust, which finds its way into the housings of electric motors where it gradually destroys the insulation's resistance until flashover occurs. To safeguard motors as well as to practice good housekeeping, great pains are taken to trap and remove all the carbon black at the point of application. At the McCreary plant, a large-diameter pneumatic suction tube extends to the intake of the Banbury mixer to whisk away the dust and paper bags in which the powdered ingredients are delivered in accurately weighed quantities. As an extra precaution, motors in the millroom are shielded from dust.

Sulphur is the only additive that cannot be put in the batches made ready for the first of two passes through the Banbury. It is the principal vulcanizing or curing agent and should not be present where temperatures might exceed 290°F, the point at which vulcanization begins. As might be expected where extreme frictional forces are at work, a great deal of heat is generated in the

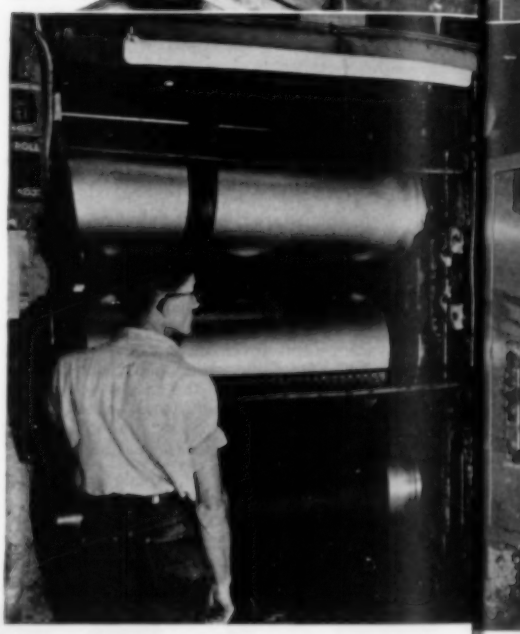
RURAL FACTORY SETTING

The McCreary plant (below) doesn't lack space or clean, fresh air. The pond in the foreground is now provided with a spray system to supply additional cooling capacity during hot weather. The stack marks the location of the power plant that houses coal-burning boilers and steam-driven generators ranging in capacity from 100 to 540 kw. Offices and manufacturing departments are in the center of the picture, and at the left are a warehouse for finished tires, the shipping department and an employee recreation room.



PROTECTED MOTOR

Tire-tread rubber contains 30 percent carbon black. During compounding, it is added as a fine powder, which is a source of trouble. Exhausters draw much of it away, but sometimes motors are nonetheless enclosed, as shown at the left, to protect their inner workings.



mixer and, unless controlled, would cause vulcanization, which must be avoided until the end of the operations when the assembled tire components are molded into one unit by heat and pressure. In other words, if any part is inadvertently cured at an early manufacturing stage it would not unite with the other members and an imperfect product would result.

Incidentally, the process of vulcanization is declared to be the most important basic development in the rubber industry. It was discovered accidentally by Charles Goodyear in 1839 when, in the course of his research work with rubber, he dropped some gum elastic mixed with sulphur on the stove in his kitchen. The gob he scraped off possessed many of the qualities that he had been trying to impart to rubber.

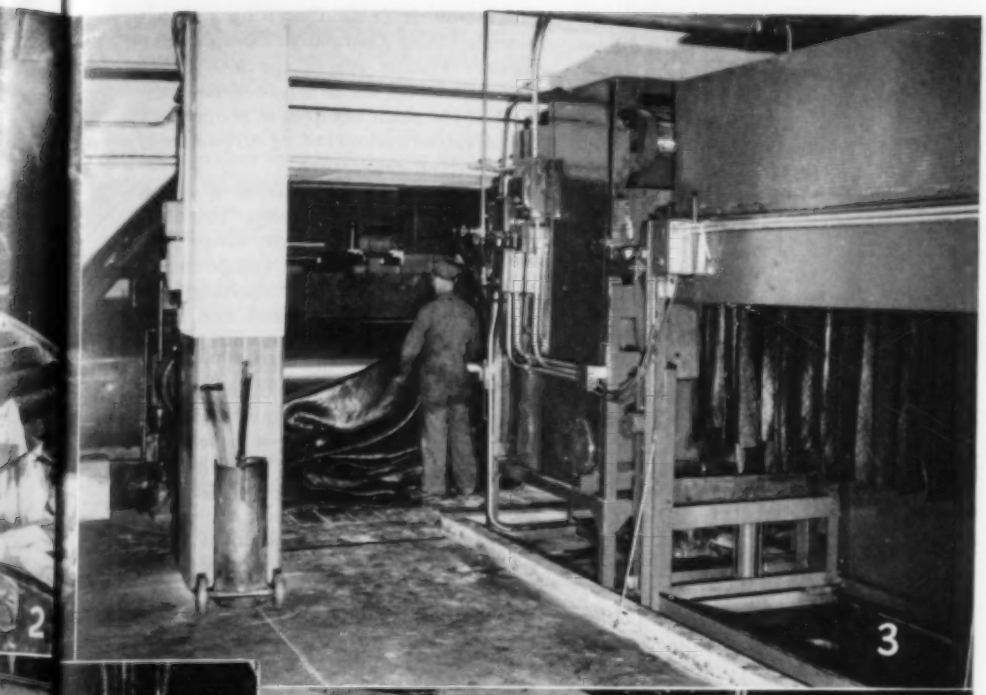
Heat is generated at many other points in the plant where rubber compounds are mixed or formed. Some increase in temperature is desirable and frequently intentional to condition the materials for subsequent operations, but it must be kept below vulcanization level. This is done by circulating cool water through the rolls and body of the Banbury and the rolls of calenders, mixing and warming open mills, extrusion machines (tubers), etc. To provide the large volume of cooling water needed for this purpose, an Ingersoll-Rand steam-jet refrigeration unit is used in conjunction with a cooling pond.

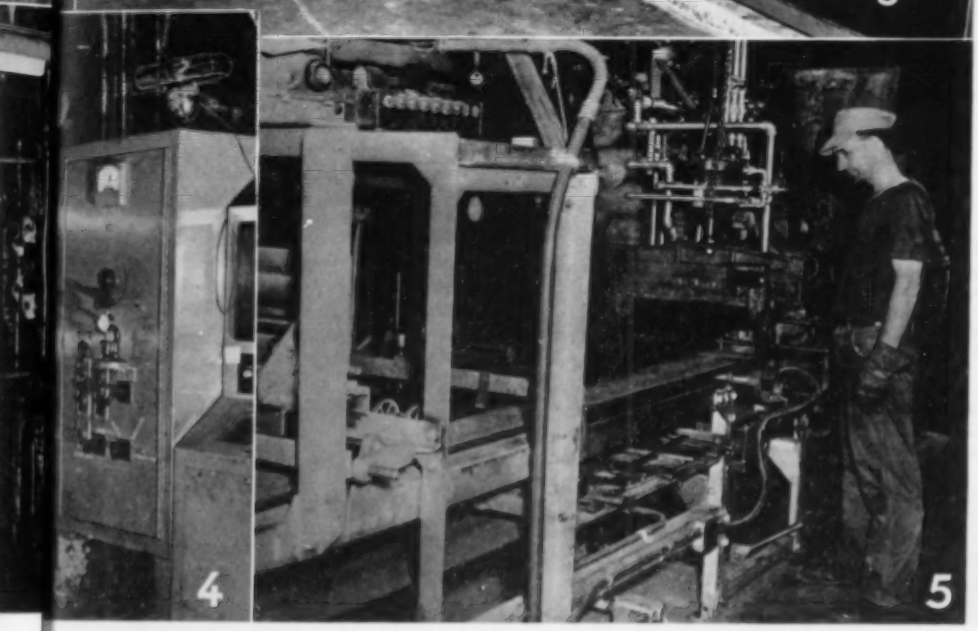
When the 400-pound batch is in the Banbury, a pneumatic ram is lowered onto the mass to force it into the digesting rolls. As the raw rubber is torn asunder and thoroughly mixed with the powdered ingredients, gobs of the masticated material drop out and are fed into an 84-inch mill, known as the sheet-off mill, which has water-cooled rolls and produces a ¼-inch-thick continuous sheet of "green" or unvulcanized rubber. This goes to a batch-off machine which passes it through a soap solution to reduce its tackiness and cuts it into 3x6-foot slabs that emerge on a moving conveyor where they are cooled by a stream of air from a fan. Folded into easily handled sizes, the slabs are transported to the Banbury for compounding with sulphur and possibly a few other ingredients. As the green rubber entering the Banbury is as soft as putty, the temperature generated during this second pass through the mixer is not as high as during the first one and there is no danger of vulcanization, even though sulphur is present.

After the second pass through the Banbury and the sheet-off mill, the rubber is further mixed as it is rolled by open mills into sheets of desired thickness for subsequent processing. From this point on the material, depending upon the application for which it is compounded, is variously routed to a calender which rolls it into sheets that are pressed into prepared cotton or rayon cloth, to a tuber from which it issues in properly dimensioned strips for treads, or to an extruder which combines it with wire to form tire beads. Camelback—tread rubber that is shipped to retread shops—forms a substantial part of McCreary's production. It is backed with rubber-coated polyethylene to which green rubber will not adhere.

Plies of rubberized cord fabric are the foundation upon which tires are built. These tough sinews, when chemically treated, rubber-impregnated and expertly joined, form the base on which the beads, flippers, breakers, sidewalls and treads are assembled. The cord is as important as the rubber itself in making tires that will meet today's rigid specifications covering traction, shock absorption and wear resistance. For years, long-staple cotton was the most popular material, but of late many manufacturers prefer rayon for their premium-grade tires and particularly for service where heavy loads have to be supported at sustained high speeds. McCreary uses rayon for plies and cotton around the steel bead area.

Fabric suitable for tiremaking presented a major problem in the early days, and its development entailed years of painstaking research. When the first all-rubber pneumatic tire made its appearance it was realized that tough sinews of some sort were needed to hold





WORKING THE RUBBER

1 RUBBER CUTTER: Crude rubber is received in 225-pound bales and reduced to sizes that can be manually handled. It is cut by forcing it by aid of a motor-driven plunger assembly against the electrically heated knives seen at the far end of the machine.

2 COMPOUNDING: Initial mixing is done in a No. 11 Banbury by an operator who knows his formulas like a chef knows his recipes. The metal boxes contain weighed and bagged additives for a 400-pound batch. In front of the worker is a pile of rubber that has been through the mixer once. The masticating, water-cooled rotors of the Banbury are driven by a 600-hp. motor. Atop the mixer is a large air cylinder that actuates a plunger in the throat of the machine to hold the charge against the rotors, the pressure used being varied by controlling the air admitted to the cylinder. The round dial behind the operator is a timer, and the square chart below it is a temperature recorder. At the right of the mixer is the intake of an air-operated paper-bag and dust disposal system.

3 GOB TO SHEET: This 84-inch mill receives gobs of compounded rubber by gravity from the Banbury mixer and rolls them between its water-cooled cylinders into sheets of green rubber ¼ inch thick. On the right is a batch-off machine that removes the material from the mill, runs it through a soap solution, cuts it into slabs and hangs them on a moving conveyor to cool in a stream of air.

4 CALENDERING: This 3-roll, water-cooled calender is used to coat rayon tire fabric with rubber. On the extreme right is the control panel of a beta-ray gauge that continually records the weight of the material in pounds per square yard as it is being calendered. The strip of rubber being fed into the machine from above came from the nearby warm-up mill that conditions the compounded rubber for this precise operation.

5 EXTRUDER: This 8-inch tuber is extruding a tire tread that is being carried away by a conveyor belt. A scanning electric eye controls the speed of the belt so as to insure treads of uniform weight.

the unit together. Experiments with malleable-iron wire and other materials were abandoned in favor of cotton. However, because the intersecting threads of that fabric were continually flexed in service they sawed against one another, thus weakening them and generating heat that burned the life and resilience out of the tire.

Different weaves were tried and resulted in a material with cords running in only one direction and held together by fragile cross threads that broke in the mold during vulcanization. That construction proved to have marked advantages, and researchmen pursued their investigations to find a pattern that would reduce fatigue and give added strength. The plies of present-day tires are made up of parallel cords of a special weave insulated from one another by a layer of rubber during the calendering operation, which is discussed later. But when the low-pressure tire became popular, flexure increased appreciably both in number and extent and necessitated an improvement in cord design. Rayon then entered the field by reason of the fact that it proved to be resistant to the destructive internal heat caused by excessive flexing.

Rayon cord is delivered to the McCreary plant in 600-yard rolls 4-feet wide and is treated with Lotol, a solution of synthetic-rubber latex, plus certain chemicals that give the fabric added strength and a certain amount of resilience. This is accomplished by machinery which unwinds the roll as it passes through a bath of Lotol and rewinds it for drying, which is done with the aid of infrared lamps in a large oven heated by steam at about 300°F. Then the material is taken to an air-conditioned room to await further processing in a calender. Dipping is a continuous operation, the end of one roll being spliced to the next in line in a matter of 25 seconds by use of a quick-curing cement and vulcanization in an electrically heated press at 400°F.

The calender is a triple-roll machine in which the fabric is thoroughly impregnated with compounded rubber under carefully controlled conditions. To insure perfect union, both the rayon and the rubber must be at the exact tem-

peratures specified, and to that end the hollow rolls are supplied with steam and cold water, as required. The amount of rubber applied to the cords also must be closely regulated. To achieve this, nuclear physics has been brought into play in the tiremaking industry. Hand gauges and visual inspection have been replaced by a beta-ray instrument that automatically measures the material and records its weight. It is a Model R AccuRay manufactured by Industrial Nucleonics Corporation and consists of a gauging element and of a visual indicating mechanism. The former is made up of a split arm through which the calendered fabric travels. The radioactive source—Strontium-90—is in the lower branch of the arm, while the detector is in the upper one. The intensity of the radiations after penetration varies with the weight of the material and is registered directly in pounds per square yard on the recorder at the calender-operator's station. Thus, he can tell at a glance whether or not the rubber-coated fabric meets specifications and make adjustments before tolerances are exceeded. The net result is a saving in both labor and rubber and a product of uniform quality.

Following this first pass through the 30- to 40-yard-per-minute calender, the material, now coated on one side, is run into a tower of open rollers where it is air cooled by means of fans and rewound with a nonadhesive liner. A second pass through the calender coats the other side. After being cooled and rerolled, the fabric is cut into breakers and plies for tires of different types and sizes. Cutting is done on the bias so the layers will conform naturally to the tubular section and the cords of one ply will not parallel the cords of the adjacent ply. The strips are then cut into proper lengths and rolled individually for the convenience of the tirebuilder.

The rigid ring found on the inner periphery on each side of a tire is called the bead. It must fit the wheel rim perfectly and is therefore tailored with precision. The copper-coated steel wire and small strips of rubber used in making the bead are kept in a room maintained at 120°F and fed into a machine that extrudes the rubber onto the wire, which is further heated by a gas flame. Many of these rubber-covered wires, cut to length, are wound into a bundle and wrapped with rubber-treated cotton fabric to form the bead core. For heavy tires these cores are wound one or more times with "noodles"—extruded rubber strips—and wrapped, as before, with rubber-impregnated cotton.

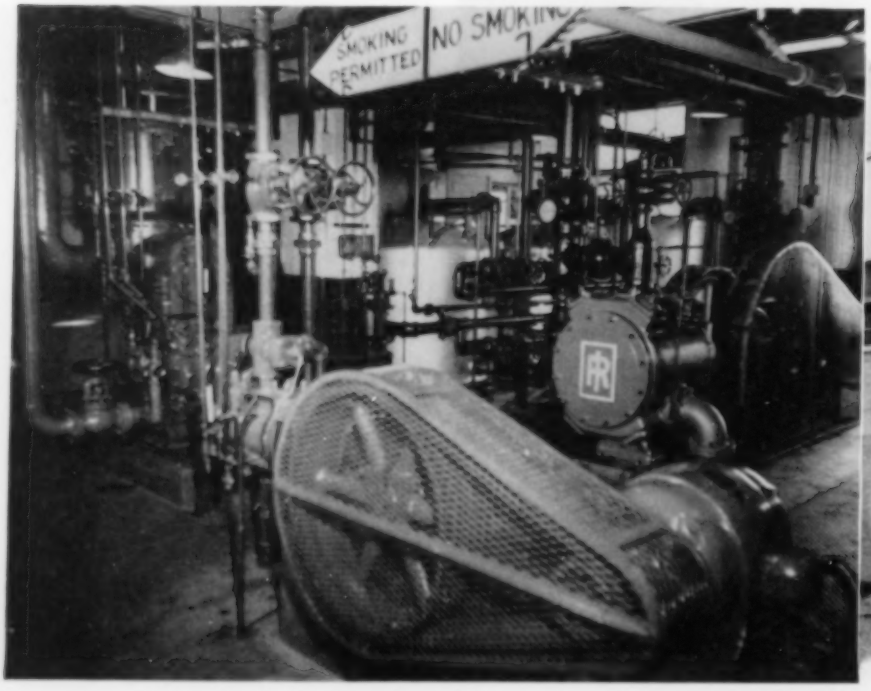
The three open mills that condition the rubber for treads, camelback, noodles and sidewalls are on the floor above the extruders and are driven through a shaft and magnetic clutch by a Vilter Manufacturing Company 500-hp steam engine. This is one of the few places where steam serves as a power medium. Most of the plant equipment is operated by individual motors taking current from steam-driven generators.

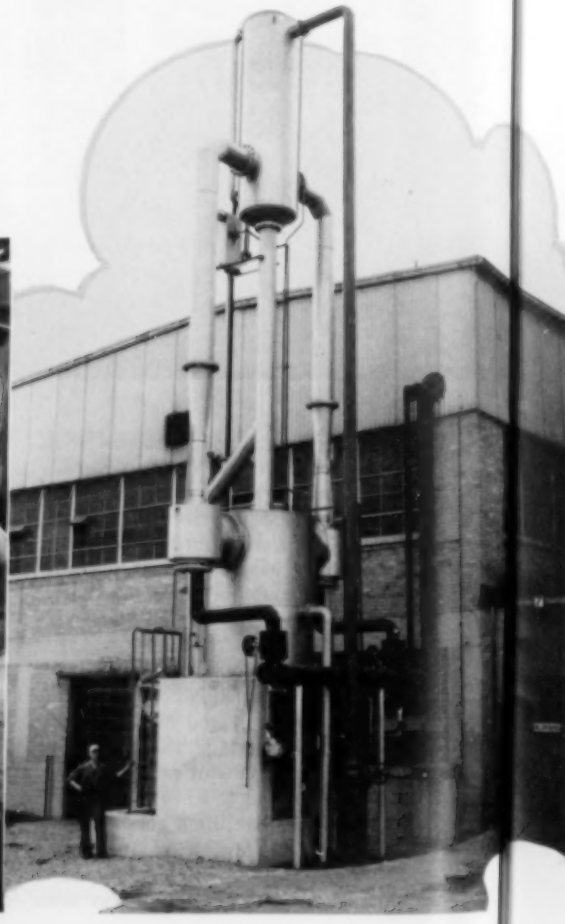
When the plasticized rubber is at the right temperature—between 180 and 225°F—it is fed in narrow strips into the tuber for which it is compounded. It enters by way of an opening in a cylinder with a heated head and a revolving screw that forces it out through a die. If intended for treads, the extruded material is cooled by running it through a tank of cold water before it is conveyed to the skiver—a motor-driven, water-lubricated circular knife that cuts it into proper lengths by aid of an electric eye. After each cut, an air cylinder lifts the knife mechanism above the skiver table so that it can be returned to the starting position.

Next the treads are placed on a rack for a 24-hour shrinking period and are then run through a press which punches holes in each on about 1-inch centers with a spiked plate actuated by a pneumatic cylinder. The holes serve as a means of escape for the air trapped in depressions in the curing mold in which the tire is expanded to give it its final shape. A record is now made of the weight, size and compound of the tread,

ACCESSORY EQUIPMENT

Shown here are different types of Ingersoll-Rand equipment which render essential services in and around the factory. Below are three compressors that furnish air at 100 psi pressure for operating the expanders and the Banbury plunger, for the air bags used in the tiremaking process and for general plant purposes. The apparatus stationed outdoors, right, is a steam-jet refrigeration unit that chills about 2700 gpm of water to 55°F for cooling the heat-generating rubber-working machines. On the next page is a battery of Cameron pumps. Some of them supply the flash chamber of the refrigeration machine with water; others deliver chilled water from that unit to points of use; still others serve the spray heads at the cooling pond and furnish water for general application.





of the date and the operator handling it.

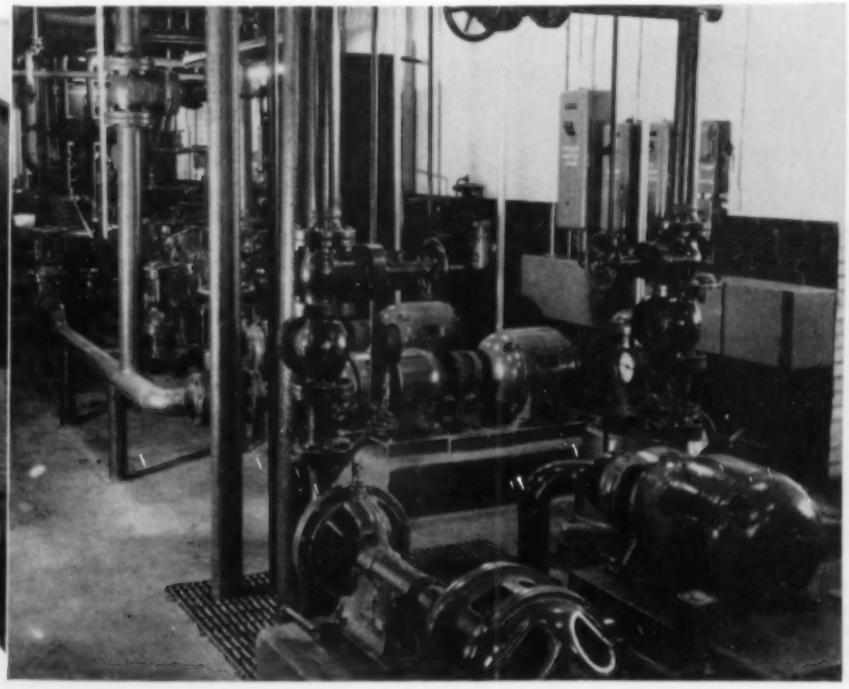
All the components of a tire are routed to a common point—to the builder with his collapsible revolving drum or form. On this cylinder he expertly lays a number of plies with the cords of the first one running in one direction and those of the second in the opposite direction, and so on, to form a weave that will insure a product possessing strength and flexibility. Next come the beads, flippers, more plies and breakers (parts between the plies and the tread) for additional strength; then he places chafing strips around the bead for further protection against rim wear; and finally the sidewall and tread are put in position.

As assembly proceeds, the builder is busy directing high-pressure rollers and other shaping tools against the form in order to tie all the parts securely together. Called "stitchers," the rollers are mounted on arms powered by pneumatic cylinders. When satisfied with the job, he collapses the drum, and the "green" tire, which looks like a barrel without heads, is slipped off and hung on an overhead conveyor traveling to the next manufacturing stage.

The embyro tire is now given preliminary shape in a pressure-vacuum expander. In this ingenious airtight chamber it is laid flat on a pneumatically operated vertical ram which, when raised, exerts pressure against both sides of it, pushing the walls inward. At the same time an outward pull is exerted on the tread by suction created by an Ingersoll-Rand air compressor converted into a vacuum pump. The result is a crudely formed carcass into which an air bag, often called "curing tube," is forced by a pneumatic ram and inflated with air. But before this is done, a soapstone-naphtha lubricant is sprayed on the inner wall of the tire. The bag is made of a specially compounded rubber for toughness and coated with glycerine so it won't adhere to the tire during molding.

Next comes the most important step in the whole process—vulcanization or curing in a split mold which receives an object that wouldn't support your car around the block and transforms it into a tough, sinewy tire that will take road abuse for thousands of miles. Temperature, pressure and time must be carefully controlled during the operation, which takes about 40 minutes for the average automobile tire and as much as 2 hours in the case of a large truck tire.

The inner walls of the mold, like a giant waffle iron, have all the characteristics and features of the finished product. When the carcass is admitted, the contained air bag is attached by means of two connections to a hot-water system that circulates water at 320°F and 240 psi pressure through it. Simultaneously, steam in the mold case raises the mold-plate temperature to about 300°F. Each press is equipped with a Taylor Instrument Company Flex-O-Timer that automatically regulates the length of the curing period and with a Fulscope that controls and records the temperature in the air bag and in the mold to bring about optimum results. Air at 20 psi is used to actuate the Flex-O-Timer, which is essentially a motor-driven drum with adjustable pins. The latter trip pilot air valves which, in turn, open or close steam, water and air valves at the proper time during vulcanization. Between curing cycles the mold is blown clean with compressed air and is then sprayed with a silicon-base lubricant that prevents the tire from sticking to the mold.



Bag curing, as described, has some serious drawbacks, which have been successfully overcome in recent years through the development of an automatically operated vulcanizing press by The McNeil Machine & Engineering Company, Akron, Ohio. In this press, called the Bag-O-Matic, the expanding bag is incorporated in the mold. Although the plant has doubled its capacity since 1949, when the machine was put in production, output has lagged far behind demand, and McCreary has had to wait until this year to install its first unit.

The advantages of the Bag-O-Matic over the older system are manifold. In the case of the latter it is necessary to carry a large stock of air bags of different sizes corresponding to the tire sizes manufactured. At the best, their life is relatively short, for they are generally useless after approximately 100 "cures." To safeguard against failure when in the mold, each bag is tested for leakage after every application by inflating it with air and immersing it in water. A pneumatic ram holds it submerged, and the presence or absence of bubbles gives visual indication of its unfitness or fitness for further use. When the tire is removed from the mold it goes to a debagging device which distorts it and holds it open at one point by an air cylinder while a hook at the end of the piston grabs the curing tube and pulls it out.

The bladders built in the McNeil press are good for some 300 cycles even though they are thinner walled than the conventional type to permit more rapid heat transfer. A plant fully equipped with such units needs no bagging and debagging departments, no conveyor system to connect the two with the vulcanizing room and no pressure-vacuum expander, because everything required for final shaping and curing is incorporated in the Bag-O-Matic. Costly rejection of tires damaged during bagging and debagging are eliminated, and one operator can easily take care of as many as twenty presses (40 molds) that take up no more space than the older machines and reduce vulcanizing time by 30 to 40 percent.

When a McCreary tire comes from the mold it is ready for finishing, which includes removing mold extrusions, cleaning and polishing the exterior surface, balancing it to mark the point where the inner-tube valve stem should be put and painting the outside with a spray gun. Then it is visually inspected for defects. If up to standard, it is conveyed to the shipping department. This is in an adjoining building and is modern in every respect—even boasts a pneumatic-tube system connecting it with the main office for the fast exchange of messages.

Delving into the Past with Modern Tools

To Save Time and Money the Technique of Archeology Is Undergoing Changes

Charlie R. Steen

PRELIMINARY EXCAVATION

Where conditions permit, overburden is excavated with bulldozers down to the previous "occupational" level where study is to begin. To make sure that preliminary digging will not go below the desired horizon, a trench is first dug with hand tools, and paper targets are placed in a line, as shown, about 6 inches above the objective, plus the height of the dozer blade. The earth above this level is then removed in a series of pushes.

THE archeologist has long been noted for using the smallest of tools. He is usually pictured squatting beside the bones of some long-dead hunter painstakingly removing soil from the bones with pointing trowel, dental tools and small paintbrush. There are very good reasons for the exercise of care and skill, because bones and other remains that have been buried for hundreds or thousands of years in damp earth are often so rotten that they disintegrate upon exposure for study. In the case of particularly important finds, skeletons must be uncovered a little at a time and each section allowed to dry before painting it with a hardener and preservative, usually a synthetic resin.

It is the archeologist's job to reconstruct, as completely as possible, the life of our human predecessors—of groups of men who existed in the days before systems of writing were developed. The materials he has to work with are pitifully small, and he cannot hope to discover at any site most of the tools and utensils used by the people who once dwelt there. Imagine what would happen if one of our modern towns or villages were suddenly abandoned. The inhabitants would take with them all objects they considered valuable and would leave a litter of broken tools, furniture and so on.

GETTING DOWN TO DETAILED WORK

After rough preliminary excavating has been completed, men move in with shovels to begin the real work of exposing the remains. The dark horizontal streak running to the left in front of the kneeling workman was made by an accumulation of charcoal at a level that was the ground surface during some previous period of occupation. The picture was taken within the reservoir area to be created by the erection of Falcon Dam in Texas.

It doesn't take long for deserted houses to start falling apart. Roofs soon cave in, walls topple, and within a "few years" a series of mounds marks the sites of former homes and crumbling masonry rises here and there above the midden. A "few years," incidentally, means a short period in relation to time as measured by those who deal in centuries rather than in terms of one man's life span; a couple of generations would probably witness the complete disintegration of even a well-built modern town.

And what of the things remaining in and around the houses? Paper, textiles, wood, and many metals would soon rot, while some perishable materials, burned but not entirely destroyed, would, like charcoal, last wellnigh forever but would be so fragile that slight handling would cause them to crumble into black dust. So, our abandoned community, once full of useful and beautiful gadgets and conveniences, would be mostly heaps of rub-

ble containing glass, pottery, bricks, and rust-resisting metals—the same sort of residue with which the archeologist must piece together the story of ancient civilizations.

Reconstructing the past has been greatly aided by the fact that man, no matter where or when he lived, has usually sought the same sort of location for his home, one that met his needs—proximity to food supply and water, a moderate amount of shelter from prevailing winds and adequate drainage. As a result, groups of people have often dwelt continuously or at intervals in one area over great stretches of time. Today there are towns in the United States built over prehistoric Indian villages, and in the Old World many cities, notably Paris, Rome, Athens and Jerusalem, have been inhabited for thousands of years.

As primitive man tossed broken or discarded tools and other possessions onto trash piles, the latter grew until they became great mounds, or, where refuse was simply thrown outdoors, entire townsites gradually rose higher and were built on ever-mounting midden. This is well demonstrated in some parts of India, particularly in the flatlands of Bengal where small villages have occupied the same spot for several hundred years and now rest on hills of debris 6 to 10 feet high. If one of these piles were excavated, the remains of the first people who lived there would be found at the lowest level and near the center, while higher levels would represent later periods of occupation.

In exploring such mounds the archeologist's chief concern is to record the positions of artifacts in proper relation to one another and to the strata of earth which overlie the original site. Styles in dwelling places, wearing apparel and tools changed in the past as they do today and are revealed by slowly and painstakingly removing the soil in layers. Aside from discarded objects, house floors, storage pits, burials and other structures give him information. In the case of a grave, for instance, it is possible by carefully excavating with a trowel to establish its relationship to a particular level in the mound, for the disturbed soil in the pit dug for the interment will differ in color or texture from that surrounding it. Thus the top of the pit is easily determined and, incidentally, the surface of the ground at the time of burial.

Because of the danger when excavating of destroying evidence of days gone, archeologists have long been reluctant to use anything bigger than a pick or shovel, which are generally depended upon for "rough" work. For many years, however, heavy overburden was often removed from sites with horse-drawn slips and Fresno scrapers. But diggers have had to cast about for other means of clearing away sterile soil, and since World War II there has been a tendency to take advantage of modern earth-moving equipment.

On the Missouri and other river systems throughout the United States have been and are being built or contemplated big dams to control floodwaters and to produce electric power. The reservoirs created have inundated great stretches of lowland with hundreds of important archeological sites. To make matters worse, the sequence of prehistoric cultures in the Missouri Valley is little known, and a distressingly large amount of information has been lost. To prevent further destruction of evidence relating to the peoples who lived in America in pre-Columbian times, Congress, in 1946, authorized the River Basin Archeological Salvage Program by means of which the Federal Government, through the Smithsonian Institution and the National Park Service, entered into coöperative agreements with various state agencies (chiefly state universities) in an attempt to save as much material as possible before work on such construction projects is undertaken.

To explore all the sites involved would take the concentrated efforts of most of the nation's archeologists for many years. However, it is necessary only to survey the areas to be flooded to arrive at the number and distribution of prehistoric sites, to do some test digging to determine the depth and nature of the deposits, and to engage in some intensive excavating at a few of the more important points. Even this program, if done with pick, shovel, trowel and brush, would take more time than is normally available. At most, approximately five seasons can be counted on from the date engineers start work on a large dam until water is impounded behind it, and instances are reported of archeologists throwing the last shovelfuls of earth as the slowly rising waters of a reservoir wet their feet.

Under such conditions, speed is essential, but it was not until 1948 that heavy earth-moving equipment was used in the Missouri Basin. The following year the merits of the bulldozer versus the road grader were discussed. It was decided that the lighter patrol grader, which offers the operator excellent visibility, is preferable for large flat areas and for tilled land, but that the bulldozer cannot be beat for removing thickly matted or deep overburden. The former is generally utilized to strip a site, a few inches

DOING IT THE EASY WAY

A blast of compressed air will quickly remove loose dirt from cracks and recesses that can't be reached by a brush. A Navajo Indian, who is plainly more intent on the camera than his work, is shown cleaning the wall of an excavation at the Casa Grande National Monument in Arizona.

at a time, until changes in soil color indicate the presence of ancient house floors, pits or other features of a village. It can do this in a matter of a few hours, whereas it would take weeks to clear away the top soil with hand tools.

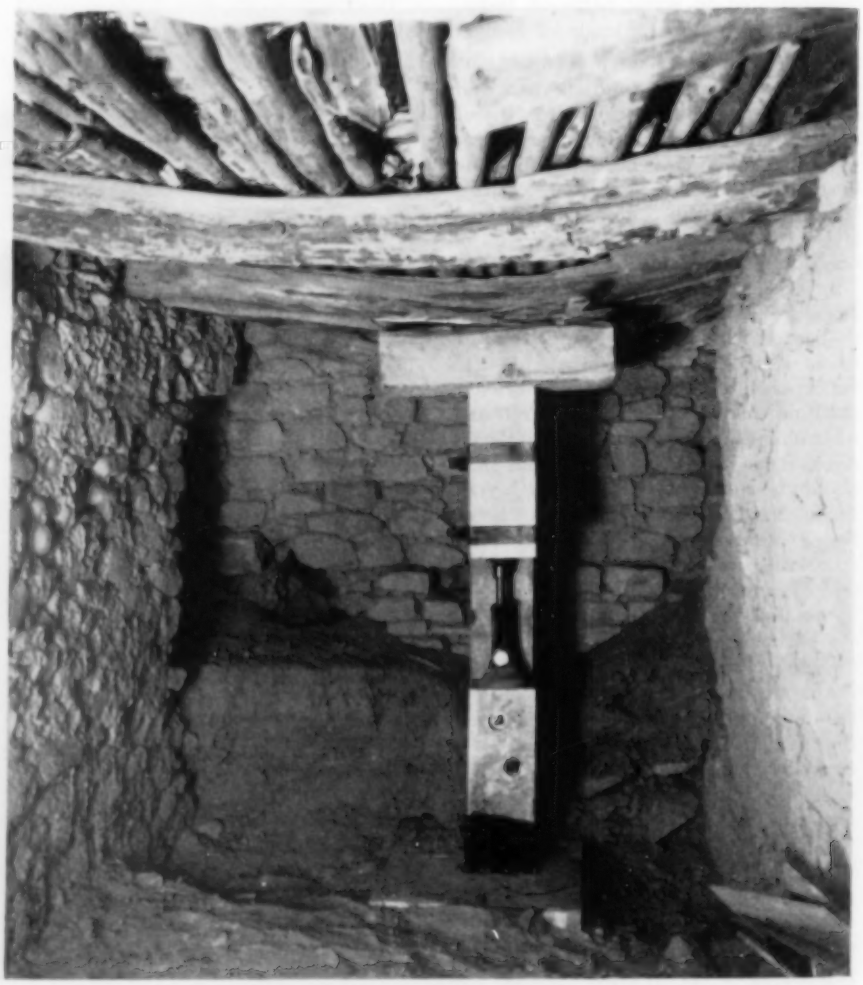
At the present time the International Boundary and Water Commission is building a large irrigation and flood control dam (the Falcon Dam) across the Rio Grande at a point about 75 miles below Laredo, Tex. An archeological survey of the area to be inundated has disclosed a number of "occupational" levels which are buried as much as 32 feet below the present terrace level and in which hearthstones, flint chips and snail shells have been found. (The snail was an important item of food for the Indians of southern and central Texas.) Bones of extinct mammals such as the elephant also have been located in the same horizons, giving rise to the belief that the sites will produce important evidence concerning the life of very early man in America. As a result, the University of Texas, the Smithsonian Institution and the National Park Service, together, have made plans to explore the Falcon Reservoir area in order to gather as much information as possible before it is flooded.

With the meager funds available, it would be too slow and costly to remove the overburden with hand tools. The procedure on the Falcon project, and with slight variations elsewhere where heavy equipment is used, is first to dig a trench with pick and shovel. To one face of the trench are then nailed paper targets, which are aligned with a level and set at a height above the occupational level equivalent to the height of the dozer blade, plus 6 inches. Using the targets as a guide, the operator can then easily clear away the ground to a point only a few inches above the horizon to be worked. The 6-inch padding below the tractor treads is sufficient to protect the site itself from serious damage and is removed with hand tools.

Compressed air has long been an aid in recovering prehistoric remains, in fact, antedates mechanized equipment in this field because an archeologist, after carefully brushing off a piece of pottery, vessel, bone or stone implement he has dug up, instinctively puckers up his lips and gently blows off any remaining dust so the specimen will be clean for making drawings and photographs. Air blowers are virtually a necessity in excavating some cave sites. Often large with small openings through which little if any air can enter, groups of men working in such confined places without artificial means of ventilation would be in danger of asphyxiation. European archeologists have explored many ancient caverns, especially in southern France and Spain, and seem to have been the first to use blowers.

An excellent example of an undertaking of this kind is a cave a few miles east of Capitan, N. Mex., which, so far as can be determined at present, was occupied by Indians for at least a couple of hundred years sometime between a thousand and fifteen-hundred years ago. The site was excavated during the summers of 1950 and 1951 by student labor under the supervision of Dr. Paul Reiter of the University of New Mexico. The mouth is about 4 feet wide and has a maximum height of 2½ feet. The cave proper, an irregular oval room some 200 feet long, 50 feet wide and 40 feet deep, is reached by crawling down a tunnel around 20 feet long. The floor was covered to a depth of about 15 feet with fill consisting largely of dirt and trash left by the Indians.

Though the back of the cave is moist from seepage, most of the fill was what is called "bone dry." Even wearing goggles and respirators, the men required a dependable supply of fresh air to do their work. After a portable, gasoline-engine driven electric generator had been installed outside and lights strung inside, a blower was set up at the tunnel entrance and a 10-inch duct extended to the rear of the chamber so the air would be forced through the cave and out by way of the tunnel, carrying with it most



SHORING UP A ROOF

Mining methods sometimes have to be used for the safety of excavators in southwestern masonry remains. The timbers in this room in the Aztec Ruins National Monument are estimated to be 900 years old. Above the roof is 12 feet of dirt. A jack had to be put in place to bolster the cracked crossbeam overhead.

of the dust raised. With a short field session (usually four to twelve weeks during the summer) and a shorter budget, the method, though not entirely satisfactory, is the one most commonly used in cases of this kind.

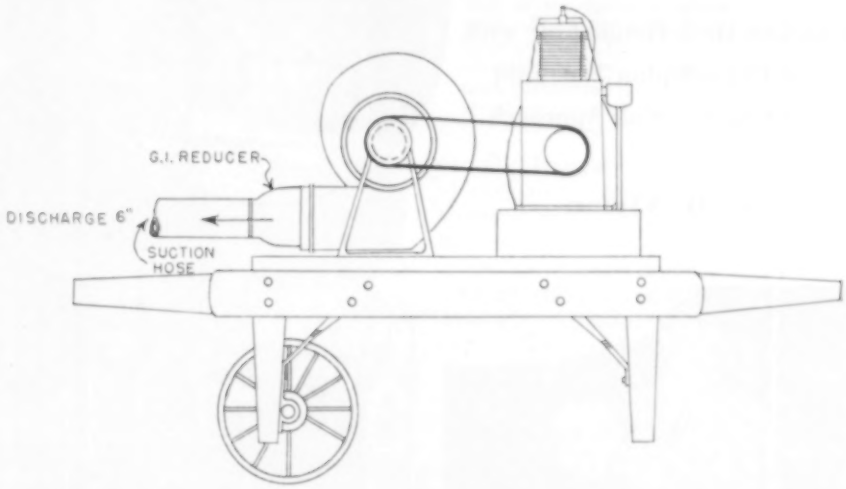
During the 1930's, Dr. Victor Smith, of Sul Ross College, Alpine, Tex., was engaged in digging a series of caves in the Alpine-Big Bend region of Texas. For those sites, which were similar to that at Capitan, he built a "dust machine" that served him for years. Using a gasoline-engine powered centrifugal fan and a flexible pipe, he removed the dust from the working area by suction and spewed it out on a hillside far from the cavern mouth. The equipment proved so satisfactory that the University of New Mexico borrowed it for excavating the Sandia Cave which produced evidence of what is believed to be the oldest man so far discovered in America. (COMPRESSED AIR MAGAZINE, MARCH, 1942.)

One innovation of World War II was the aerosol bomb that was designed to spray insect repellent into the air. Now many other products are packed under pressure into these handy little containers, and among them is a fixative that is used primarily by artists to "fix" pencil and charcoal drawings to prevent smudging. Archeologists are finding the solution very helpful because objects are often so fragile that they are damaged if handled in the condition in which they are found. With the bomb, it is an easy matter to protect them against breakage by applying a coat of the tough preservative.

Another tool that is beginning to win favor is the "one-lung" compressor, the type that supplies air for small paint-spray guns with long flexible tubing. A blast of air at 20 to 25 psi pressure, delivered through a ¼-inch tube without a nozzle, is frequently more effective than a trowel and brush in cleaning or removing the final layer of dirt from prehistoric house remains and utensils. It is also much easier to follow a cleavage plane in soil with an air hose than with a trowel. The method serves best in light to moderately light soils and must be used in the open.

Other labor-saving devices such as an endless belt to carry excavated material to a dump have been suggested, and while they would undoubtedly be useful, cost of rental, installation and operation would be prohibitive. Even road graders and dozers cannot be utilized unless the equipment is near at hand and available for short periods. All this boils down to the fact that, willing though the archeologist is to lighten his labors, the trowel and the brush still are the primary tools of his calling.

This article would not be complete without some mention of the vital part aerial photography now plays in mapping ancient remains. Since 1929, when Lindbergh flew over the Yucatan jungles to locate Mayan sites, this method of surveying has become standard practice throughout the world. It is of inestimable value on jobs like the River Basin Surveys, where time is of the essence, because much more can be seen from the air than on the ground and wearisome, time-consuming footwork is well-nigh eliminated.



WHERE EARLY INHABITANTS LIVED

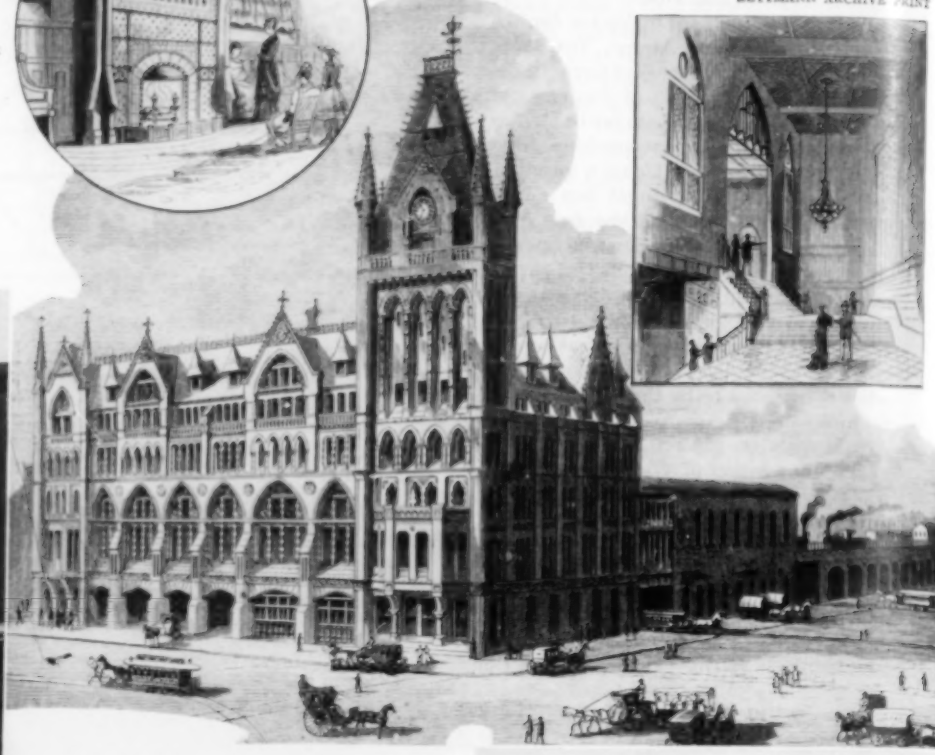
This cave in the Davis Mountains of southwestern Texas yielded important information about prehistoric dwellers in this general area. To remove dust stirred up by the workers it was necessary to rig up an exhaust system with some flexible ducts and a blower driven by a gasoline engine. So that the machine could be pushed around, it was mounted on a simple carriage, as sketched at the top.

BROAD STREET STATION PASSES

Wreckers Have Hands Full with Old Philadelphia Terminal and Chinese Wall Approach

C. H. Vivian

BETTMANN ARCHIVE PRINT



PENNSYLVANIA RAILROAD PHOTO

SAW IT OPEN AND CLOSE

Mrs. Henry P. Baily poses with President Walter S. Franklin of the Pennsylvania Railroad on the rear platform of the last train out of Broad Street Station. As a girl of thirteen she was in the station the day it went into service seventy-one years previously.

ORIGINAL STATION

The 4-story structure as an artist depicted it in the "Scientific American" of May 12, 1883. The lower building at the right, which was subsequently demolished to make an addition to the station, was the first freight depot. Note the covered wagons backed up to it. Fifteenth Street ran through a tunnel between the two structures. Stretching off to the right is the elevated approach supported by a series of brick arches. The inset at the upper-left shows the fireplace in the main waiting room on the second floor where a wood fire burned in cold weather. On the surrounding tiles were scenes from Scott's Waverly novels and also representations of mythological characters. The other inset shows the grand stairway, a structure of solid marble that was hailed as the height of elegance when the station was new.

DOWNTOWN Philadelphia is being denuded of two of its best-known and time-worn structures —Broad Street Station and the story-high vaulted brick support for the Pennsylvania Railroad tracks running into it. In its heyday the depot was acclaimed the world's largest and finest, and parting with it has aroused "sweet sorrow," to borrow words from Shakespeare. The passing of the ugly elevated railroad, on the other hand, occasions no sorrow, sweet or bitter. Philadelphians of two generations have attacked the unsightly obstruction with barbed criticism, and years ago summed up their feelings by dubbing it the "Chinese Wall."

Once, however, the station was indispensable and the city's pride. When it was at its zenith, almost 70 years ago, there were months when it handled a million passengers. Many of the world's notables and celebrities detrained there and walked down the wide marble stairway to the street. Among them was every president since Chester A. Arthur (President Eisenhower used the station while in the Army), as well as the Prince of Wales, King Albert of the Belgians, and stars of stage and sports. Even Man o' War, peerless race horse, once arrived there in a special car.

Demolition of the depot and approach is part of a central-city improvement program which was launched a full 28 years ago but which meanwhile ran into various snags. Their removal will clear 22 acres of land, valued at $12 million, for development according to modern municipal ideas of utility and beautifi-

PENNSYLVANIA RAILROAD PHOTO

AS ENLARGED IN 1893

This picture of the station, dated by the Model T Fords and the horse-drawn vehicles, was taken from the steps of City Hall and plainly shows its numerous architectural embellishments as well as the peristyle above the sidewalk. The latter helped to protect pedestrians when the building was razed. The station was designed by Frank Furness, considered the nation's first "modernist" architect.

cation. It rarely happens that a plot of that size becomes available for reconstruction in the heart of a city as large as Philadelphia.

The structures were built in 1880 and 1881 at an initial cost of $4,272,000. Most of the urban population then lived and worked in the V formed by the junction of the Delaware and Schuylkill rivers, but the closest railroad depot was on the western fringe of the city across the Schuylkill at Thirtieth Street and on the site of the present main Pennsylvania terminal. It must be borne in mind that horsecars were then the nearest approach to rapid transit. In fact, it was not until 1883 that the railroad company inaugurated hansom-cab service to and from the stations. An article in the *Scientific American* in May of that year hailed the conveyance as a "novel feature," mentioning that "these peculiar vehicles are made by Hincks and Johnson in Bridgeport, Connecticut," and adding that "we understand they are now being introduced in Washington and other cities."

City Hall, located athwart the intersection of Broad and Market streets,

ARCHED APPROACH

A view around Eighteenth Street during the early dismantling stages showing the brick-arch construction of the "Chinese Wall" that carried the tracks for 70 years. There were 60 arches of 24- and 26-foot span except at street crossings, where they measured 50 feet.

NETWORK OF TRACKS

Angular view across Market Street showing how tracks fanned out sixteen wide as they neared the station.

ATTACKING THE APPROACH

In the foreground of the top view there is still some evidence of the sixteen tracks, but at the right and in the distance all rails have been removed. Narrowing down, the approach passed to the right of the Fidelity Storage Building in the distance, and on westward to form a T-shaped connection with the main line at the Thirtieth Street Station. The other picture was taken from the wall beyond the crane at the right (top view) looking along the Filbert Street side of the approach towards the partly dismantled depot. The area in the foreground had housed air compressors and other machinery used in connection with the switching of the many trains that moved in and out daily. The ramp beyond the shovel enabled trucks to reach the station's second floor to haul out debris.

had then been under construction for ten years and was the hub of official and commercial life. So as to land passengers as close as possible to this central point, the new depot was erected just across the street from it. The original structure was four stories high. The approach from the West Philadelphia Station at first carried eight tracks, and its final 6-block stretch from Twentieth Street to the Broad Street Station was in the form of an iron-and-steel viaduct.

The depot was opened on December 5, 1881, and the first timetable shows 80 trains arriving and leaving daily. Traffic grew steadily, and the number of tracks was increased to twelve in 1890 and to sixteen in 1894. To make the skeleton viaduct section more solid and to lessen the noise of the trains it was replaced by a red-brick structure built in a series of arches and about 20 feet high. This gave the final blocks of the approach an over-all width of 300 feet so that the latter occupied the entire block between Market and Filbert streets. Beyond Eighteenth Street it was narrower. Eight of the arches had a span of 24 feet, 48 were 26 feet wide and four, over cross streets, 50 feet.

Originally all the archways were open, but those near the station were later bricked up to form solid walls and thus provide spaces for freight and express offices and to house mechanical equipment necessary to operate the line. In the latter category were two large Ingersoll-Rand compressors that supplied air power for setting signals and switches that controlled the flow of traffic over the maze of tracks. The compressors were removed before demolition was begun, but some of the offices remained in use until the approach of the wreckers compelled them to vacate.

In 1893 more ground was acquired and the depot was enlarged. The new section rose to a height of ten stories with a surmounting Tudor tower, and the upper part was occupied in 1894 by the general offices of the Pennsylvania, which had been located elsewhere. During that period a glass, arched train shed 306 feet wide, 591 feet long and 100 feet high at the crown was erected over all sixteen tracks. Around 450 trains were then arriving and departing daily.

The waiting room and dining room, the latter with a seating capacity of 500, were on the second floor and on the same level as the tracks. Ticket offices and other facilities for serving passengers were on the first floor. Both were artistically finished. Left to the wreckers was one of the largest pieces of terra-cotta ever fired—a panel portraying "Transportation and the Progress of Transportation," which the Austrian sculptor Karl Bitter had executed shortly after the enlarged station was opened 59 years ago. Another of Bitter's works, a plaque depicting "The Spirit of Trans-

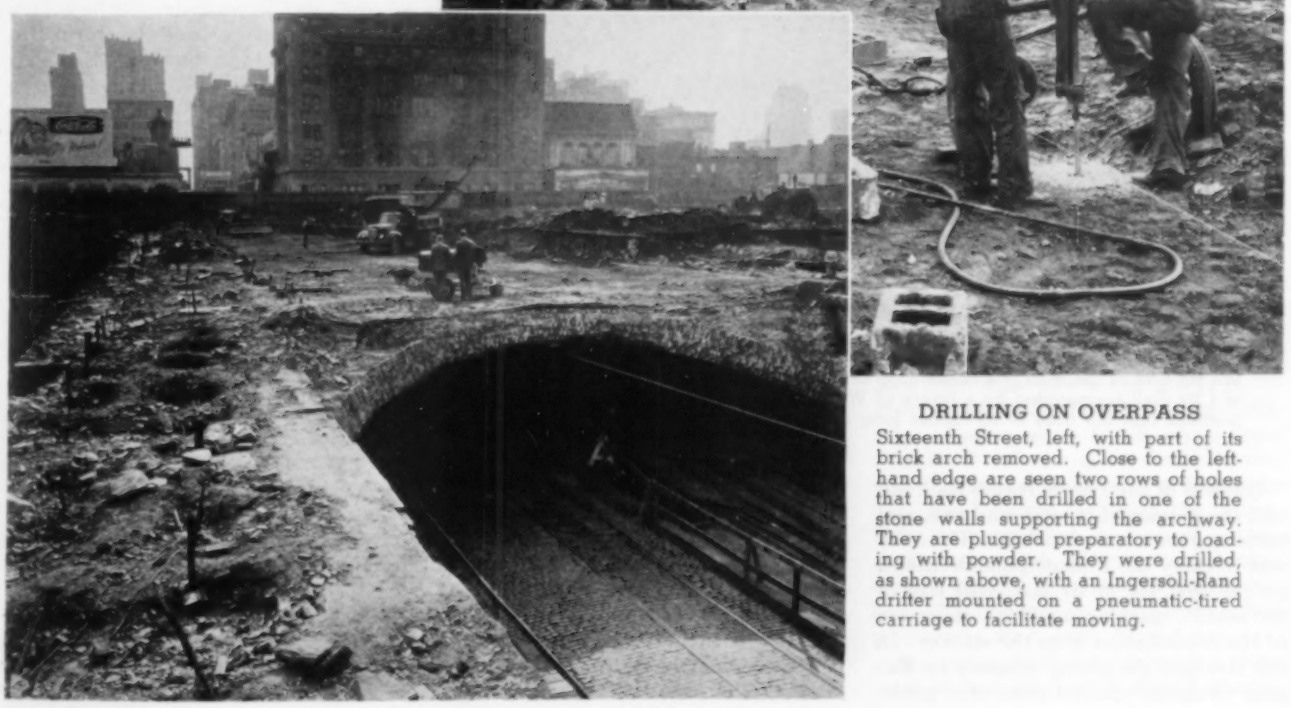
portation," was originally in the main waiting room but was removed in 1933 to the new depot at Thirtieth Street.

Beginning around 1900, the railroad company had bought some land north of the approach, just across Filbert Street, with the idea of running in more tracks, but that never came to pass. Gradually gathering force was a vigorous campaign to do away with the station and approach. The burning of the magnificent train shed on June 11, 1923, added impetus to the movement. The shed was never rebuilt, and it was known then that Broad Street Station was doomed, although many more years were to elapse before it was torn down. As far back as 1903, trains bound to and from New York were being routed through the city without going into Broad Street. The rise of the automobile and other means of rapid transportation eliminated the need of bringing all passengers into the center of town. For the benefit of commuters and others who desired to end or start trips there, an underground railway was envisioned.

The furore finally led to the signing of an agreement on July 13, 1925, which bound the railroad company and the city to carry out jointly a long-range program of civic improvement and modernization. The Pennsylvania pledged itself to construct a new underground Broad Street Suburban Station on the land it had acquired across Filbert Street and to bring subsurface electric lines into it. As a preliminary to that step some of the suburban lines that would feed most of the traffic into the new station had to be electrified. After these things had been done, the road was to remove all surface tracks leading into Broad Street. The city agreed to put the Market Street elevated railroad underground, to build additional streets near the terminal west of the Schuylkill and to widen Filbert Street, change its name to Pennsylvania Boulevard and extend it westward from its existing dead end at Eighteenth Street, with a bridge across the Schuylkill. That would involve the acquisition of some property and the construction or shifting of some water and sewer lines.

A start was made in 1927, and by 1933, when the depression suspended activities, the railroad had spent $68 million and was operating its Thirtieth Street and suburban stations and underground connecting lines. Then came the war years, when little could be accomplished. But on November 11, 1946, the parties concerned met again and agreed to resume work, which they did in 1948. In bringing about changes incidental to fulfilling its promises, the railroad has laid out $83 million, according to its executive vice-president James M. Symes, and will have to spend $12 million more. Additions at the Thirtieth Street Station to better fit it for service have cost $9 million in recent years alone, he reported. The city has made outlays totaling $25 million, and is prepared to make more. Its burden will be lightened somewhat, however, through an agreement whereby the state will extend the new Pennsylvania Boulevard to be fashioned from Filbert Street.

Like a condemned man who gets anything he wants for his final meal, old Broad Street Station was given a "party" before being abandoned to its destroyers. The last scheduled train, No. 431 for Washington, pulled out at 1:10 on the morning of April 27, but as a parting gesture a special was arranged for departure that night and the public was invited to turn out to offer its farewells. It speaks well for the sentimentalism of Philadelphians that more than 5000 braved a pouring rain to do so.



DRILLING ON OVERPASS

Sixteenth Street, left, with part of its brick arch removed. Close to the left-hand edge are seen two rows of holes that have been drilled in one of the stone walls supporting the archway. They are plugged preparatory to loading with powder. They were drilled, as shown above, with an Ingersoll-Rand drifter mounted on a pneumatic-tired carriage to facilitate moving.

TEDIOUS TASK

A paving-breaker operator and helper gouging out brickwork encasing a steel column in the process of demolishing the masonry from the top downward. On the far side of the men is a sheer drop of five stories. At the left rises the tower of City Hall surmounted by a figure of William Penn. The latter is of such proportions that the nose is 15 inches long and the waist has a girth of 26 feet.

Officials of the Pennsylvania Railroad and the municipality were on hand, and there was some speechmaking. The train was to carry the Philadelphia Orchestra on the first leg of its last road trip of the season, marking the 885th departure of the organization from the station. In full strength the group, directed by Eugene Ormandy, played piece after piece, and Mr. Ormandy paid the huge structure the compliment of saying its acoustics were good enough for a concert hall. The crowd bought 4384 souvenir tickets as mementos, and close to 700 persons were able to get aboard the train to ride as far as the main terminal or the North Philadelphia Station.

At 9:57 on the dot, the engineer got the signal to pull out, and the train moved off very slowly with five members of the orchestra on the rear platform accompanying the assemblage as it sang "Auld Lang Syne." On the following morning, in the almost deserted building, Mayor Joseph S. Clark, Jr., and M. H. McCloskey, head of the company that had contracted to reduce the edifice to rubble, officially set razing in motion by jointly barring down some once-prized interior ornamental stonework, while cameramen recorded the scene. It was the most important wrecking job Mr. McCloskey had ever undertaken. Most of his undertakings call for building things, and they are often of considerable size.

The demolition job being carried out by McCloskey & Company is a tedious one because of the location. Put the same structures in an outlying district and let the contractor topple them with dynamite as he might please and the site would have been cleared months ago. But because of their situation at the crossroads of a city of nearly two million people, it has been impossible to close off streets, and so far the work has been done without so much as dropping a brick outside the boundaries of the structures. The station was literally picked to pieces from the top downward. As it was torn apart, brick, stone and steel were dropped or chuted inside to the first or second floors and trucked away.

With explosives banned, the most effective tools were air-operated paving breakers and oxyacetylene cutting torches. Upwards of 30 breakers were brought to bear, 21 of them Ingersoll-Rand PB-8 models. Portable compressors that supplied them with air were located on the ground, and a profusion of hose lines was run up stairways and elevator shafts. The workmen soon found out that they were not playing with cream-puff construction.

The terminal had been put together stoutly and might easily have lasted out the century or longer without crumbling had it been left unmolested. Exterior stone and brick walls were backed up heavily with red-brick courses, the whole knit together with time-resisting mortar. Interior walls were mostly of brick alone, but thick enough to give trouble. In many places rope slings were arranged to support a paving breaker in a horizontal position, with one man operating it and a partner removing dislodged masonry with a prying bar. After inside walls had been cut free at the ends, they were often pushed over with improvised battering rams and then broken up into chunks that could be readily handled.

The skeleton of the station was composed of approximately 4500 tons of steel of the Bessemer variety. It was thicker in section than that now used for the

same purpose and therefore took longer to cut with torches. No effort was made to salvage the steel, but many of the bricks were taken to a cleaning site to be restored to usefulness. For the most part, however, stone, bricks, mortar and miscellaneous debris were trucked off for disposal in areas that needed fill. The average round trip required an hour.

Out on the approach wall the contractor has also met some surprises. No estimate had been made of the steel it embodies, but a great many girders have been found in places where they were not expected. Near the depot, where the arches had been closed, the interior of the structure, as already mentioned, was honeycombed with brick-walled rooms occupied by clerical staffs or machinery. On top of the approach had been laid steel members to support the track. Spaces between girders had been backfilled with earth, which the wreckers are moving effectively with bulldozers to points where it can be conveniently loaded into trucks by power shovels. An American crane with a 70-foot boom lifts out steel sections and other heavy members as they are broken loose.

Most obstinate of all are the arch structures at street underpasses. There cross thoroughfares, slightly depressed, go through tunnels 300 feet in length. The arches of brick vary in thickness from 4 feet at the crown to 8 feet at the sides, and the heavy masonry abutments, usually 18½ feet thick, rise from 18 to 20 feet above street level. Built of granite, quartzite and sandstone blocks, they rest on piers of concrete extending into the ground as much as 30 feet in places.

TEARING OUT A VAULT

Paving-breaker crew attacking the heavy brick wall of a vault on the fourth floor where records were kept. Rubble was wheeled in barrows to chutes leading down to truck-loading stations on the second floor.

As all these streets carry heavy traffic, every effort has been made to obstruct them for as brief a period as possible. This was especially true at Sixteenth Street on which trolley cars run, as the traction company's bill for stoppage of service was $1500 a week. Because of the type of construction involved, it was necessary to resort to blasting, but by drilling and loading a large number of holes in a block the number of detonations was reduced to a minimum. In the brick arch, holes extended almost but not quite through the structure, while those in the stone abutments were drilled 10-12 feet deep on 5-foot centers and in two rows 6 feet apart, with the outer ones 6 feet from the edge. Drilling was done with wagon-mounted drifters using Ingersoll-Rand Jackbits on 1¼-inch hollow, round steel. Starting bits were of 2⅞- or 2¾-inch gauge, and the deeper holes were bottomed at approximately 2-inch diameter.

PHOTO FROM "THE BULLETIN," PHILADELPHIA

A FALLEN ARCH

View of Sixteenth Street with a part of the overhead arch blasted down. An American crane has a sling around a massive masonry block to lift and load it into a truck. Three paving-breaker operators are working on the muck pile reducing large pieces to sizes that a power shovel can handle.

The first blast, which was designed more or less to test the effectiveness of the shooting plan, was set off in the predawn hours of Sunday, October 27. One result was more than 200 telephone calls from hotel guests and others in the vicinity asking if there had been a disaster of some sort. In all, seven shots were fired to break down the first arch, and this served to develop a technique that was followed in razing the others. Prior to each blast, the street underneath is covered with 12x12-inch timbers to protect it, and heavy mats are laid over the section to be demolished to prevent fragments from flying.

As a measure of the volume and character of the operations, it should be men-

PENNSYLVANIA RAILROAD PHOTO

AREA BEING CLEARED

Print of aerial shot, looking westward, on which have been blanked out the sections which will be available for development after clearing operations are completed. In the foreground is the tower of City Hall.

tioned that a force of up to 235 men has been on the job steadily since last April and has only recently reduced the station and four blocks of the elevated structure to ground level. The crews are now working west of Eighteenth Street. In addition to wrecking, the McCloskey contract calls for excavating and setting steel in an underground passageway wide enough to carry three additional tracks into the Suburban Station. Only one track will be laid now, the others are to follow when needed.

It has not been decided just what will be erected on the cleared land. The most recent proposal put forward by Robert W. Dowling, president of the City Investing Company in New York, calls for a business, shopping and hotel district similar to Rockefeller Center in that metropolis. Six buildings, 25 to 30 stories high, would surround an esplanade. One structure would provide parking room for 1500 motor cars. The cost of the project is estimated at from $75 million to $100 million.

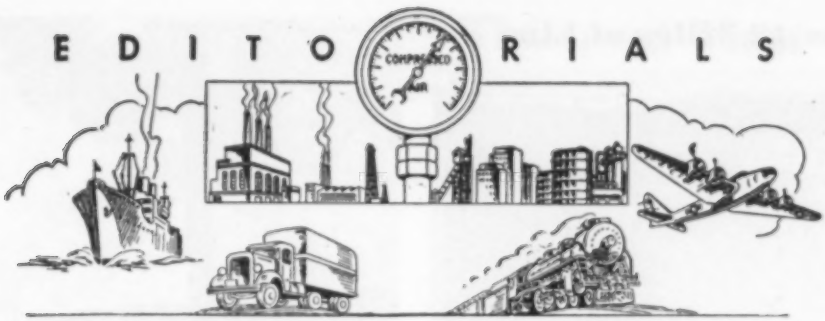
Some adherents of the modernization program favor tearing down City Hall and including the site in the improvement scheme. This would open up both Broad and Market streets, and eliminate skirting the 4-block plot on which the edifice stands. Should their ideas prevail, which is doubtful, a wrecking job of huge proportions would result. In their zeal to change the city's face, members of the anti-Hall faction have attacked the building as a monstrosity.

On the other hand, Dr. Robert C. Smith, an authority on such matters, terms it "a remarkable representation of 16th century French Renaissance architecture." And City Architect George L. Lovatt, Jr., thinks that if the building were in Paris Americans would probably rave about it and even pay for the privilege of going through it.

Its removal was first advocated many years ago by Paul P. Cret, architect and University of Pennsylvania professor. More recently, however, stout defenders of the old Hall have appeared. It is, in fact, a remarkable structure in several ways. It is larger than the capitol in Washington, only 7½ feet shorter than Washington Monument and contains 622 rooms. The walls of its 100-foot-square tower are 22 feet thick at the base, to mention one eyebrow-lifting statistic concerning the solidity of its construction. The building was started in 1872, not completed until 1907 and cost $24,344,355. After mulling over the pros and cons of its right to existence, Sidney G. Hantman concluded a recent article in the *Philadelphia Inquirer Magazine* with this prediction:

"Despite all the controversy, it is safe to assume City Hall will stand for a long time where William Penn wanted it. The very task of razing the building perhaps would take years. Last year workmen shaved 20 feet of the granite curbing to make a driveway for official cars at the northeast corner of the Hall. Working with pneumatic hammers and drills, sledges and picks, it took two to six men all of six days to do that job."

Anyway, the staid old object of the argument is going to look a little different now that its smaller but almost equally tough neighbor has departed.



THE ENLARGING CIRCLE

IN A SERIES of articles on Canadian mining history that appeared in these pages in 1935 and later, R. C. Rowe likened the discovery of ore at Cobalt, Ont., in 1903 to the casting of a pebble into a pool of still water. Just as the pebble causes ripples that go out in ever-widening circles, so did the men who were trained at Cobalt and the money that was made there radiate to other sections of the country and open up more mines. And, in a sense, the pattern still persists. In Canada, as elsewhere, riches taken from the ground seem to have a way of going back for more.

Take the case of the Steep Rock iron mine. It comes to mind now because of the news that the Inland Steel Company, a United States concern, has taken a 99-year lease on 1200 acres of Steep Rock deposits and thus insured itself an ore supply for a long time to come. Steep Rock was started on its way to production with money obtained from gold mining. The iron was there all the while, but it took the venturesome spirit and curiosity of a gold miner to go after it seriously.

Steep Rock is a monument to the acumen and persistence of the late Joseph Errington, who had successfully promoted the Little Long Lac, MacLeod-Cockshutt and Negus mines, all gold producers. To understand the situation, let us go back a few decades. Iron has never had the allure of gold for prospectors, but the Canadian Government recognized long ago that it is the foundation of industry.

As far back as 1883, the Dominion offered a bounty of $1.50 a ton for pig iron made from domestic ores, but little money was called for. Later the offer was extended to cover the proportion of Canadian-mined ore used in conjunction with ore from the United States. Subsequently the Province of Ontario volunteered to pay a bounty of $1 a ton and, as recently as 1937, its legislature sought in the same manner to stimulate the search for commercial ferrous deposits. There was little response, although prospectors continued to look for and find gold despite the deterioration of its once enviable position as a symbol of opulence.

Meanwhile, Canada had lots of iron ore, but it was as yet undiscovered, and our northern neighbor was getting virtually the entire supply for its steel mills and foundries from our sources of supply. Ironically, ore had been reported in the Steep Rock area in 1897, but nobody investigated. And in 1905, H. L. Smyth, a member of the Harvard University geological staff, did some work there and predicted that extensive deposits would be found. Still nothing was done. Finally, in 1938, Julian C. Cross, a Port Arthur geologist, went over the ground and reiterated previously expressed opinions. But there was no rush of prospectors; in fact, not one went near the place. They simply were not "iron-minded."

Eventually, Errington and some of his associates in previous ventures, including D. M. Hogarth, put up the money to prove or disprove the presence of ore by means of diamond drilling. No one paid any attention to them, and the holes that gave evidence of deposits were drilled in ground they had not staked. They filed on it later, at their leisure.

Following this favorable prospecting, the men formed a company and began the gigantic task of diverting a river and pumping a lake dry to give access to the ore bodies underneath. Fourteen pumps, each driven by a 500-hp motor, reduced the level 7 inches a day by lifting two million tons of water every 24 hours—half enough to supply New York City. The shallowest deposit was 70 feet below the surface, and after the water was disposed of it was necessary to remove thousands of tons of silt. Mining got underway in 1945, and the output has been increasing steadily. The price of iron also has been rising, and it is interesting to note that ore from Steep Rock now brings more per ton than did the gold ore at Little Long Lac.

Thus we find the ripples still moving outward from Cobalt. We also find the once iron-rich United States going across the northern border for ore to keep its steelmaking juggernaut running at full speed. Curiously, Inland can get its supply cheaper from Steep Rock than from our own Great Lakes ranges. Port Arthur, where the ore is loaded into Lake Superior boats, is 120 miles closer to Inland's Steel plant at Indiana Harbor (near Chicago) than is Superior, Wis., loading point for ore from the Mesabi Range.

We find, too, that money earned in gold mining is helping to develop another Canadian source of iron ore—Labrador. American and Canadian interests are putting millions into the venture. The Canadian funds come from the Hollinger, the Dominion's leading gold mine, located by ex-blacksmith Benny Hollinger.

WHAT MATERIAL?

CHOOSING the right material for industrial machines or processes is not as easy as it sounds, and it is getting more complicated all the while. There are now more than 25,000 materials to pick from, and the list is rapidly growing longer. In the field of metals, alone, there are 15,000 known alloys. The rise of plastics has brought a new flood of materials, and modern ways of treating wood have made lumber more adaptable than ever before.

Suppose you are going to make "widgets" and you have tentatively selected the material for their outer case. To judge whether it is "best" for the purpose involves the consideration of many things. Some of the questions that will arise are: Will it do the job assigned to it? How does it compare in cost with competitive materials? Is it readily available now and will it continue to be if a national emergency should arise? Will it give your widgets sales appeal? Can it be processed economically with your machinery? After weighing these and many other factors for a few days or weeks, you will perhaps end up rather confused. And, if your widgets must withstand high or low temperatures or varying humidities in world-wide trade, your headache will grow worse.

This problem of choosing what to use in manufacturing hard goods has become so pressing that it is to be given special attention. In New York, in June, there is to be a 3-day discussion of all its phases by experts from leading industrial concerns. The general aspects of materials selection will be taken up during the morning sessions, and the afternoons will be given over to technical and engineering considerations of the properties of new and old materials.

Supplementing the program will be a 5-day display of hundreds of different materials, with well-versed attendants on hand to explain their merits for various applications. The whole presentation is to be called the Exposition of Basic Materials for Industry. Heads of twenty leading manufacturing companies are on the sponsoring board. This promises to be one "show" that should be worth the effort spent in arranging it and the cost involved. It is predicted that 15,000 interested engineers and production men will attend.

Union Pacific Changes 42 Miles of Line

STARTING THE ATTACK

Shown are Ingersoll-Rand wagon drills and portable air compressors beginning work on one of the rock cuts. Equipment of this type was much used in drilling blast holes for the removal of 2.4 million cubic yards of rock.

ONE of the largest railroad construction jobs carried out in the country in recent years was completed on the Union Pacific System in February by Morrison-Knudsen Company, Inc., of Boise, Idaho. It involved grading a new 42-mile link between Cheyenne and Dale Creek, Wyo., to reduce the grade up the western slope of Sherman Hill from 1.55 percent to 0.82 percent. The new route is 9 miles longer than the old one, but will save up to fifteen minutes in the running time of climbing westbound trains. Eastbound trains will continue to descend via the original shorter line. In crossing Sherman Hill, the Union Pacific tracks reach an elevation of 8014 feet, the highest on the system.

Morrison-Knudsen forces began work in February, 1952, with an 18-month deadline, but good organization of the job, modern equipment and favorable winter weather enabled them to finish in a year, even. In that period they drilled, blasted and moved 2,400,000 cubic yards of rock and excavated and shifted 4,600,000 cubic yards of earth. With up to 600 men working in eight groups, they handled as high as a million cubic yards of material a month during the peak of operations.

To establish grade, it was necessary to make 118 major cuts and 111 major fills. The largest cut is a 165-foot-deep gash in solid granite near the Dale Creek end of the job from which 398,000 cubic yards was removed, hauled four miles and deposited in a 164-foot fill at Tex Creek that contains 750,000 cubic yards of material. Under a separate contract the same firm placed drainage structures, including 500 culverts ranging in diameter from 18 inches to 15 feet.

Union Pacific track-laying crews kept pace with the grading gangs, and the rails were in place throughout the new stretch of line in a matter of hours after the last dirt had been moved. The change cost the Union Pacific about $17 million and is the most extensive one made on the line since it became the first transcontinental railroad with the driving of the famous golden spike at Promontory Point, Utah, in 1869.

LIGHT BUT STRONG

The tote boxes shown here are made of aluminum and were designed by the Aluminum Company of America for handling scrap and finished products. Each is 60x42x36 inches in size, will carry a 500-pound load and weighs only 245 pounds as compared with the 620 pounds of a comparable steel container. They are mounted on low runners and provided with lugs to facilitate lifting and stacking by fork truck and dumping. Five hundred are in use in Alcoa's Cleveland, Ohio, plant.

Air Power Keeps Firm Competitive

THE magazine *Steel* reports that Aero Fastener Corporation, of Burbank, Calif., which makes screws, rivets and fittings for the airplane industry, is able to hold its own in competition with larger concerns through savings effected with air power. When drilling metal, for instance, it utilizes air-operated vises, usually on drill presses, to hold the work. Instead of actuating a vise with the usual pedal, it is arranged to close when the press spindle descends and to open when the spindle is raised. After this technique had been tried out with success, it was decided also to provide the drills with air to produce uniform pressure throughout the feed and to permit adjusting the pressure according to the kind of metal which was being drilled.

On a screw-heading machine pieces are ejected by a jet of air. Precision grinding of some surfaces is done by an air-powered device attached to a lathe. The grinder operates at speeds up to 60,000 rpm, and the use of more costly special equipment has been discontinued. Adoption of air chucks on lathes and other machine tools has reduced loading and unloading time, which is especially important because most of the operations are of short duration. Definite figures as to the over-all benefits are difficult to compute, but D. C. Whitehead, a partner in the firm, estimates that air power has increased production about 25 percent.

This and That

"Now don't give me any trouble. I already had a hard day at the breakfast table."

Great Diamond Hunt

Industrial diamonds are so costly, so scarce and so useful in the automotive industry that the larger factories have set up methods for recovering a good share of the bits broken off or worn away in the course of machining operations. Diamond-pointed cutting tools are used for finishing car parts to ultrafine dimensions and for truing or "dressing" grinding wheels. Many of the latter are, in turn, impregnated with diamond powder or "bort" and are employed for shaping and sharpening tungsten-carbide tools, the hardest man knows how to make. A single car manufacturer may have more than 7000 of the diamond-bearing tools and wheels in service.

Diamond dust worn away in grinding operations is sucked into bags by vacuum attachments on the machines. Sludge from wet-grinding processes is trapped in settling tanks and the diamond particles are extracted from it. One company retrieved 8800 carats of diamond dust and fragments in three years. This is roughly four avordupois pounds, worth $20,000, and represents about 11 percent of the firm's annual diamond requirements.

* * *

Cook Paid More Than Scientist

Scientists weren't as well paid as cooks a century ago, L. G. Simmons of the U. S. Coast and Geodetic Survey told the American Society of Civil Engineers last month. The 1849 gold rush attracted so many people to the Pacific Coast that the Survey decided to chart the coast and harbors in the interest of safety. George Davidson, an assistant in the organization, arrived in San Francisco in 1850 to direct the work. He received $800 a year and had to pay for his own meals. A cook who was engaged to see that the party ate well commanded $125 a month and his expenses.

* * *

Famous Mosaics Restored

After more than twenty years of work, ten great religious mosaics in the St. Sophia Museum at Istanbul, Turkey, have been restored to their original tenth and twelfth century condition. Prof. Thomas Whittemore, founder of the Byzantine Institute in Washington, D. C., directed the operations from 1932 until his death in 1950, after which Prof. Paul A. Underwood, an authority on Byzantine art and archeology, took over. The mosaics are made up of about 52,000 fingernail-size fragments of marble, porphyry and glass per square yard. Gold and silver were fused with the glass to help form the pictures and to reflect light without distorting the design. The tiny pieces are embedded in plaster coatings applied to a brick backing.

* * *

Still Going Down

Lake Shore Mine, Canadian gold producer, is holding its place as the deepest mine in the Americas. It will sink its No. 4 internal shaft to approximately 8125 feet vertically below the surface and open mining levels at 7950 and 8075 feet. No. 4 shaft starts at the 5200-foot level.

* * *

Name Often Printed

Newcomb Carlton, largely responsible for developing the Western Union Telegraph Company into a network of two million miles of wires, died last month. Although known as a modest and retiring individual who shunned public appearances, his name was probably printed more times than that of any other man active over the same span of years. It appeared on every telegraph blank for 29 years, and they were produced by the millions to

"I wish I could tell you what it is, but the President clamped the security lid on all military construction."

"What's so unusual about it? Everybody uses air tools now."

supply company offices, railroad stations, hotel rooms and numerous other public places.

Mr. Carlton started out as a consulting engineer in Buffalo, N. Y. Selected to direct the Pan American Exposition there in 1899, he witnessed the assassination of President William McKinley and helped carry him to an ambulance. After serving with the Bell Telephone Company and Westinghouse, he became a vice-president of Western Union in 1910 and was president four years later. All messages were sent in the Morse code when he came upon the scene, but he introduced typewriter-type senders and receivers and other mechanical facilities. Never an inventor himself, he aided and encouraged many a man who was.

* * *

Compressed Air Helps Out Steam

Compressed air and steam may occasionally be competitive, but here's an instance where they are partners. At Pass Christian, Miss., Merritt-Chapman & Scott Corporation is precasting concrete piles and floor slabs for a 4-lane, 10,198-foot-long highway bridge it is building across a shallow bay. The slabs are cast in half-width sections that weigh 122 tons apiece. Twenty of them can be produced at a time in a yard 660 feet long. To transfer them to a barge after they are strong enough to be lifted, a gantry crane, running on 50-foot gauge tracks, straddles the yard. Two 2-cylinder steam hoisting engines mounted on top of the gantry drive a common shaft which, through a pinion-gear reduction assembly, drives four hoisting drums each hooked to a 10-foot hoist line.

When in operation, it was found that the racing of the engines to make up for the low gear reduction and the multiple-part lines depleted the boiler's supply of steam before the load was lifted and shifted. Rather than expend the time and money required to increase the boiler capacity, the project manager, Roger Hand, decided to try using compressed air to help out the steam. A line from an Ingersoll-Rand 500-cfm compressor was connected, and when the steam pressure fell below 120 psi the air was turned on. The experiment was successful, and from then on steam and air worked together.

* * *

Start Was Romantic

Not all the things conceived in hardship belong to a bygone age. The Hagan Corporation, of Pittsburgh, Pa., which makes, among other things, air-operated combustion controls, owes its origin to two men of what C. F. Kettering called "the vanishing breed of attic inventors." They were John Hopwood and Thomas A. Peebles, and their first brainchild, created in an attic, was a device to proportion the fuel, air and water input of an industrial steam boiler in accordance with the demand for steam. That was in 1918.

The concern now has two subsidiaries and seven factories. The aim of another of its early investigations was to get at the truth as to why boiler tubes fail. That was in the era of quack remedies such as oatmeal, wheat chaff and molasses. After four years of study in coöperation with the U. S. Bureau of Mines, Dr. Ralph E. Hall of the Hagan staff came up with "Hagan phosphate," a molecularly dehydrated compound that makes it possible to maintain a chemical equilibrium in the boiler water and thereby control deposition of scale.

* * *

Like Duz Air Does Everything

Simple ways of solving knotty little problems with jets of compressed air are continually cropping up. At Arner Company, Inc., Buffalo, N. Y., pharmaceutical manufacturer, a carton occasionally went through the packaging conveyor line without receiving its intended contents and caused the firm embarrassment when a customer got an empty. It won't happen again. From random materials—a piece of ⅜-inch pipe, an air-pressure gauge and a regulating petcock—an inanimate pneumatic detective was rigged up to watch the line. Pressure from the plant air line is adjusted so that the force of the jet will blow off an empty carton but have no effect on a filled one.

Textile-industry customers of Rohm & Haas Company complained that a semisolid chemical paste they buy from the firm was difficult to get out of the cylindrical fiber drums in which it is marketed. The problem was solved by boring a ½-inch hole in the bottom of each container and plugging it with a cork prior to filling. Now a drum of paste is tilted, the cork removed, and air at 10 psi pressure directed into the opening from a plant air line. The paste slides gently into the mixing vat.

"I don't know where this sand came from, but all the boys are busy panning it for gold."

Pressure Suit for High Fliers

SPACE SUIT THAT'S REAL

An airman dressed in the Navy's high-altitude pressure suit that carries its own supply of compressed air and oxygen and automatically brings them into play when the external pressure drops unduly, thereby creating an artificial internal atmospheric environment. It will sustain life at an altitude of 100,000 feet and permit the wearer to parachute safely to earth.

NEW attire for the Navy's high-altitude fliers closely resembles popular conceptions of the interplanetary space suit. A pilot wearing it may survive if the cabin of his jet or rocket plane loses pressurization in rarefied atmosphere or if he has to bail out from a great height. It also enables humans to reach altitudes never before attainable.

Unless an artificial atmosphere is created, pure oxygen alone will not keep a person alive at elevations exceeding 50,000 feet. And in the near vacuum above 63,000 feet blood will "boil" at normal body temperature, the body will expand to twice its normal size and death will occur in a few seconds. The plexiglass-helmeted rubber suit automatically inflates whenever the pressure surrounding the wearer drops appreciably and creates an artificial environment for him. It applies counterpressure to the body with compressed air and supercharges the lungs with high-pressure oxygen.

Developed under contract for the Navy by the B. F. Goodrich Company, of Akron, Ohio, the suit is an outgrowth of efforts by the firm's engineers extending over a span of nearly twenty years. They began in 1934 when the late Wiley Post, aviation enthusiast, came to Goodrich with an idea for protective garb to be worn at high altitudes. He wanted something that would withstand internal body pressure in thin air so that he could break the height record held by Lt. Renato Donati of Italy. A year later he wore the suit and with it reached an altitude of 42,000 feet. That garment is believed to represent the first attempt to create an artificial environment for a pilot. It is now in the Smithsonian Institution in Washington, D. C.

Goodrich resumed development work in 1941 at the request of the Air Force, which wanted a suit of that kind because efforts made at the time to pressurize B-17 bombers were not working out as planned. Eventually pressurization was achieved, and the suit became unnecessary. However, experimental models were produced until 1945 and tested under simulated high-altitude conditions. There was no opportunity for operational testing because War II planes seldom flew higher than 35,000 feet and pilots got along all right with oxygen masks.

In 1949, because of the altitudes attained by jet and rocket research aircraft, the need to create an artificial environment for the pilot became apparent. Goodrich offered its assistance to the Navy and received a contract for an improved type based on the principles it had developed. The model seems to be generally similar to the T-1 announced last fall by the Air Research and Development Command, U. S. Air Force. The T-1 embodies a crash helmet, oxygen mask, earphones, microphone, goggles, defroster and oxygen bailout bottle. It had an unexpected and unplanned test when the cabin of a Bell X-1, a rocket-powered research craft, lost pressurization while the plane was flying out of Edwards Air Force Base, Calif., with Lt. Col. Frank K. Everest at the controls. When the suit automatically inflated he knew what was happening and was able to save his life and the multimillion-dollar craft.

The following concerns produced the major equipment for the T-1 suit under Air Force contracts: David Clark Company, Worcester, Mass.; International Latex Corporation, Dover, Del.; Bendix Aviation Corporation, Teterboro, N. J.

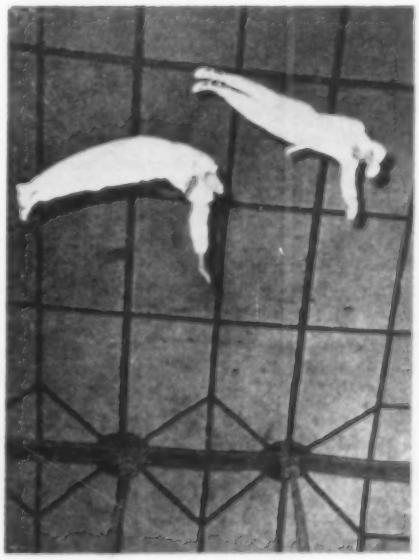
Human Cannonballs Now Fly in Pairs

A NEW twist has been given the spectacular circus act of shooting a human being from a makeshift cannon with a charge of compressed air. In Germany, a boy and a girl now leave the muzzle together and travel 70 feet into a net.

Eduardo Zacchini, an Italian, originated the act on the Isle of Malta in 1922 after much experimenting. He made his own cannon of aluminum for lightness. Compressed air at 200 psi pressure was stored in a chamber at the base and released by a quick-opening valve at the appointed instant to actuate a piston and thus eject the human projectile from the bore at high speed. A firecracker and smoke gave the illusion of an explosion.

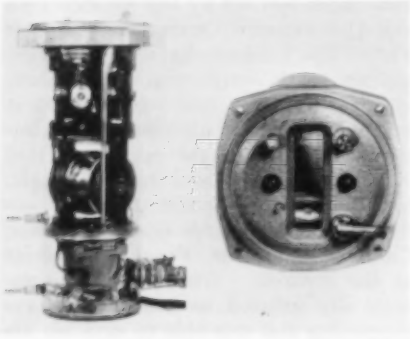
Zacchini performed his sensational maneuver the world over, and then his daughter Victoria took his place and traveled with the Roy Rogers Circus. At the time we covered the act in January, 1948, she had been shot out 2000 times without sustaining a scratch. Heavy clothes are worn for protection against skin burns from friction.

The dual actors are Leon Dinnat and Jarina Seflova. One of our pictures shows them occupying separate compartments in the barrel of the cannon for a takeoff, and the other one caught them flying through space "with the greatest of ease." They say they have only two worries: that the cannon be inclined exactly at an angle of 48° from the horizontal to give them the desired trajectory and that the air pressure be just right to give them the correct push.



Industrial Notes

Fischer & Porter Company has developed a portable pressure-measuring instrument that is said to be as accurate as the most sensitive mercury manometer but far more rugged and convenient to use. Called the Press-I-Cell (pronounced precise cell), it is said to meter with an accuracy of one part in 5000 and to have a sensitivity of one part in 15,000 though the instrument is only 5 inches in diameter and 14 inches long. Its 600-inch scale is calibrated in intervals of 1/16 inch, which represents 1/10,000 of the full pressure range, and is printed on a 35-mm strip of film that is virtually unaffected by temperature and humidity changes. Two models are available: one in which the proper scale position is set manually and the other in which that is done by a servomotor. The meter is not intended as a substitute for standard measuring instruments used where extreme accuracy is not required.



SIDE AND TOP VIEWS

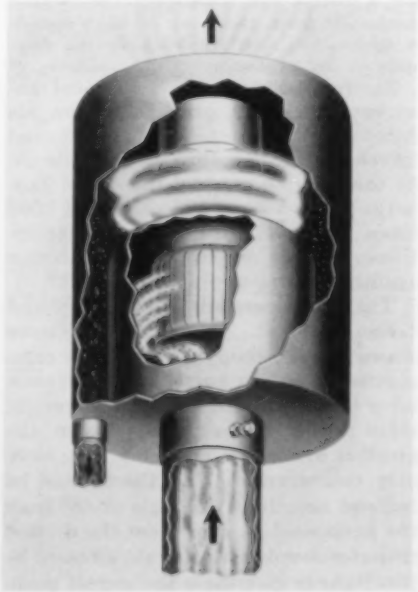
Shown at the left is the automatic pressure-measuring instrument with its transparent case and scale removed. The servomotor is at the bottom. The only part exposed when the meter is mounted in a panel is the top that gives the reading. The scale pictured at the right belongs to a manually operated Press-I-Cell.

After June 30, buses and trucks provided with air brakes and engaged in interstate traffic will have to be equipped with an audible or visual signal that will give warning of pressure failure in the air line leading to the brakes. With this in view, Rochester Manufacturing Company has designed a pressure-operated switch actuated by a diaphragm in a steel housing 1½ inches in diameter. When the pressure in the air line drops below a predetermined point, the diaphragm closes the switch contacts to sound an alarm or light a lamp.

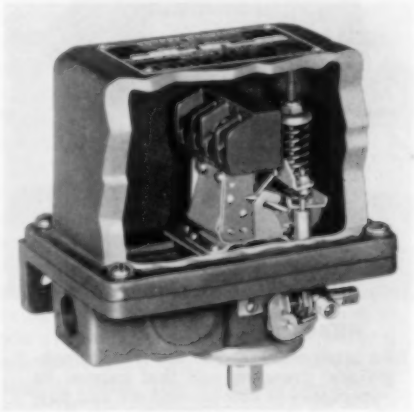
Natural, synthetic or silicone rubber is being bonded in specified thicknesses to metalwork by a special process developed by Advance Rubber Company, which is set up to coat parts supplied by customers. For certain products a resilient covering would be a decided advantage. Metal inserts in rubber bushings, for example, would give them rigidity, and rubber-metal valves would provide a seal of more than normal tightness at high and low pressures even where grit is present. Parts of well-nigh any shape can be processed, and components with metal cores can be ground to tolerances of 0.002 inch, plus or minus.

According to a study made by General Electric Company, the nation's railroads have made a phenomenal gain in electrical generating capacity in the last decade. Today they are equipped to produce 18,000,000 kw, or 900 percent more than in 1942 when the available units were barely sufficient to develop 2,000,000 kw.

Pollution of the atmosphere has many strikes against it, and anything that is designed to help overcome the nuisance deserves consideration. The V. D. Anderson Company is offering something new in exhaust heads for industrial smokestacks that is said to remove objectionable oil, process liquors, etc., from exhaust steam and vapors before they are vented. Upon entering the purifier, the steam encounters a stationary centrifugal element that imparts to it an extremely rapid rotational motion, with the result that any entrained dirt particles, guck, oil or moisture is thrown outward against the wall where it flows down and out into a drain while the clean, dry steam is discharged into the atmosphere. As the unit has no moving parts or filters, maintenance is negligible. Standard models are provided with a slip-on or flange connection for the stack and a threaded drain connection, but purifiers are made to specifications. The stationary centrifugal element upon which the effectiveness of the head depends is a new design developed by the company.



For service in the presence of explosive atmospheres or where highly combustible fuels are handled, Square D Company has introduced a new pressure switch for water pumps and air compressors. It is housed in an explosion-resistant enclosure that is designed to meet Class I Group D specifications and is available in two types. The pump switch is designed for a pressure range of 20 to 80 psi and the compressor switch for 40 to 200 psi. The latter is obtainable with a 2-way release valve. The operating mechanism is of the snap-action type insuring positive contact regardless of range or differential spring adjustment. Internal parts are protected against corrosion, and diaphragms of impregnated fabric are provided except where applications call for oil resistant diaphragms.



As a substitute for mica and other Class-B insulation, Natvar Corporation is making a tough, flexible material trade-named Aboglas. It is composed of two layers of open-weave Fiberglas with a core of varnish-impregnated asbestos paper and is furnished in sheets measuring 36x36 inches.

More accurate drilling and longer tool life are assured, it is claimed, by the use of an optically precise gauge developed by F. T. Griswold Mfg. Company for the inspection of drill points. With its Drill Point-Chek, says the manufacturer, it is an easy matter to determine whether lips of new or resharpened drills have been ground to equal angles and lengths. Any angle of point up to 145° can be measured in a few seconds, and any 2-lip drill from No. 80 up to 1 inch,

as well as drills with angles for countersinking, counterboring chamfering or for special purposes, can be gauged. The error in angle is established by a micrometer barrel graduated in degrees.

Safety prompted Arrow Engineering Company to develop a small stirrer for lacquers, paints, oils, solvents, chemicals and other flammable liquids. It consists of a stainless-steel shaft, 12 inches long, with a 2½-inch impeller at the bottom and is driven by a pneumatic motor rated at ⅙ hp when operated with air at 80 psi. Pressure used depends upon the liquid being mixed, and ranges from 35 to 100 psi.

For materials and products that are to be marked for permanent identification there is now available a fast-drying ink that is said not to chip or peel and to be unaffected by heat and weathering. It is made by John P. Nissen, Jr., Company, Glenside, Pa., and sold in a burstproof tube with a ballpoint attachment designed for use on rough surfaces

and furnished in different sizes. The ink is obtainable in six colors and suitable for marking castings, bar stock, tools, dies, fixtures and the like, as well as fur, wood, plastics, and other materials.

At one stage in the manufacture of newsprint the film of pulp, which is about 80 percent water, has to be transferred from the forming wire of the Fourdrinier machine to the first press section. That has always been a ticklish operation as generally performed and has slowed up production because of frequent breakage of the soggy sheet. This is obviated, we are informed, by a vacuum pickup and transfer system developed by the Beloit Iron Works. By means of it, suction carries the wet film to a felt blanket, to a transfer section, and thence to another felt that delivers it to the drying sections at speeds of 1600 feet per minute (modern newsprint machines generally operate at the rate of 1500 feet per minute).

American Rectifier Corporation has announced that it is now carrying in stock standard unit rectifiers from 3 to 50 kw, thus preventing delays unavoidable when custom built. They are designed to convert a-c to d-c current at the flick of a switch and require no warm-up period. Maintenance is said to be nil because of the absence of brushes, bearings, rotating windings, glass or metal tubes and foundations. The complete range of sizes made by the company ranges from 3 to 1000 kw, and 50 to 10,000 volts d-c output.

For bearings, spindles, gearboxes and small air-powered devices, C. A. Norgren Company is offering a Micro-Fog Lubricator that is designed to produce an extremely fine oil fog at low air flow. Among the advantages claimed for the unit are: constant oil level that insures a uniform rate of feed; 360° visibility of the oil flow; accurate pneumatically

MOVE MORE YARDAGE... at less COST!

Big Excavations Handled in One Operation by a

Hill of volcanic ash 250 ft. high is moved by 3 cu. yd. Sauerman Scraper which loads the material into cars using a simple ramp.

SAUERMAN SCRAPER

In far northern Alberta, Canada, valuable tar sands are dug from a river bluff by a 1 cu. yd. Sauerman scraper.

In the Andes mountains, a Sauerman scraper digs gold-bearing gravel which it bulldozes into a sluice-way.

Many difficult dig-and-haul jobs, such as the three illustrated here, are reduced to simple terms and big savings effected by use of a Sauerman Drag Scraper Machine.

An exclusive feature of the Sauerman Machine is the unique Crescent bottomless scraper bucket. Because of its streamline design, the "Crescent" penetrates hard materials with the ease of a plowshare, gathers a full load in a few seconds, then rides its load to the dumping point where it makes an instantaneous, clean dump. Twenty to forty or more heaping loads moved per hour, the exact number of round trips of the scraper bucket depending upon the length of the operating span.

The operator, sitting in a comfortable control station, easily guides the scraper over a large area. Automatic shifting of the tail end of the machine is provided where desired. Power requirement is moderate. Installation and upkeep costs are low. Sizes from ⅓ cu. yd. to 15 cu. yd. cover the needs of all material handling jobs—large or small.

Write for new illustrated Catalog A.

Rope Haulage Equipment Specialists Since 1909

SAUERMAN BROS., Inc.

548 S. Clinton St. Chicago 7, Ill.

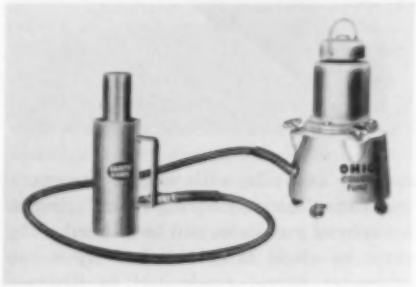
controlled metering of oil into the air line of as little as one drop in twenty minutes; and universal right to left or left to right flow without adjustment. Rated air requirements range from 0.8 cfm at 10 psi to 6 cfm at 80 psi, and maximum safe operating pressure and temperature are 150 psi and 120°F, respectively. The lubricator is suitable for ¼-inch air lines.

In the Hy-Lo type salamander announced by Scheu Products Company, the consumed gases are returned to the bowl of the unit, thus eliminating soot and smoke and improving combustion. Designed to heat small confined areas, it burns from 10 to 20 hours on one filling and is said to produce up to 140,000 Btu per hour using kerosene.

"Makes floors glow and bugs go" is the slogan for a floor wax that is also said to be a strong insecticide. Self-polishing and skid-resistant, it can be applied to cement, asphalt, rubber tile and linoleum, as well as varnished and painted wood floors. A product of Freewax Corporation, it is marketed under the name of Freewax.

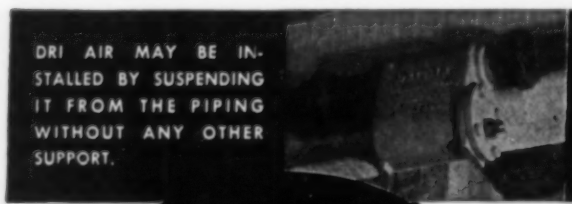
It is reported by Abraham Dor, chief engineer of Israel Mining Industries, that King Solomon's Mines have been discovered on the strength of clues found in the Bible and modern archeological research. The State of Israel is planning to work the ancient copper deposits, from which it expects to extract 100,000 tons of ore by July 1, 1953.

Hydraulic pumps and safety rams of new design have been announced by Powermatic, Inc. The former may be used directly with any cylinder, ram, press, jack or other type of hydraulic device, while the ram serves at all times to protect both the operator and equipment from harm. The pumps are powered with air from 70 to 150 psi and are ready for use when connected to a shop supply line. They are said to develop smooth hydraulic pressure from 0 to 12,000 psi without danger of overloading and of overheating when operating continuously at maximum capacity. Equipped for either portable or



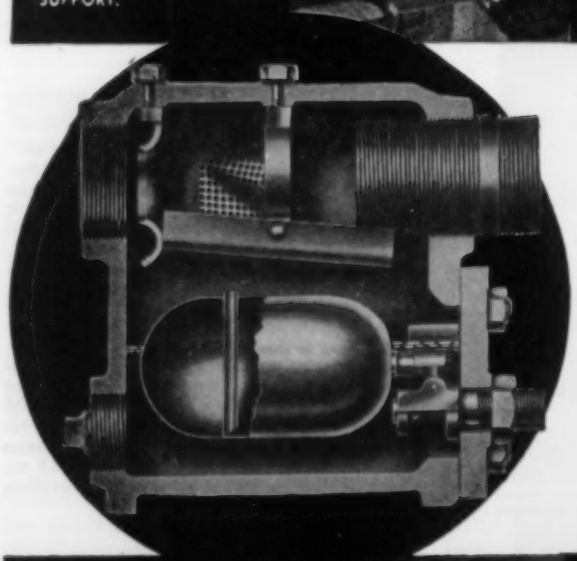
stationary service, they weigh 35 or 42 pounds, depending upon the model, of which there are eight. The safety ram may be used with any type or make of pump and is designed to unload itself automatically to prevent plunger "pop-out." There are eight sizes of 20, 35 and 70 tons capacity.

Superior Tube Company is now manufacturing seamless tubing in outside diameters ranging from 1¼ to 2 1/16 inches, sizes previously available only in welded form. It is supplied in three grades of stainless steel and in Monel metal with a wall thicknesses of 0.01 to 0.035 inch.



DRI AIR MAY BE INSTALLED BY SUSPENDING IT FROM THE PIPING WITHOUT ANY OTHER SUPPORT.

INCREASED PNEUMATIC EFFICIENCY WITH THIS AUTOMATIC SEPARATOR



PROTECT EQUIPMENT WITH

DRIAIR

SEPARATES • COLLECTS • DELIVERS

• DriAir separates and automatically ejects the condensed water and oil from compressed air lines, collects pipe scale and rust, delivers clean dry air to tools and other pneumatic equipment. This promotes better lubrication, reduces wear, increases life of tools and produces greater output. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent.

A TYPICAL INSTALLATION SHOWING DRI AIR STANDING ON A CONCRETE FLOOR NEXT TO THE WALL.

WRITE FOR BULLETIN DA WHICH FULLY DESCRIBES THE CONSTRUCTION AND OPERATION OF THE DRIAIR.

NEW JERSEY METER CO.

"SPECIALISTS IN COMPRESSED AIR DEVICES"

PLAINFIELD, NEW JERSEY

QUOTES

—FROM HERE AND THERE

Deserves Retirement

"One of the lesser known colliery workers . . . is the colliery pick sharpener. Although his craft is slowly dying in the face of mechanization, (he) is a skilled worker who, in his pithead forge, can readily assess the conditions encountered by the miner at the coal face from the amount of work he has on hand. As in most other fields, inventions have been introduced to make the colliery pick sharpener's task easier, for to make a miner's pick fit to cut coal the point of the tool must be square and really sharp.

"One member of this band of craftsmen is Mr. Ernest Hardy, who has retired after 38 years in the forge at Markham Main Colliery, Doncaster. During his 52 years on the job, Mr. Hardy estimates that he has put a fresh point on nearly 1,500,000 picks—having dealt with an average of 600 tools a week. His apprenticeship, which lasted seven years, was served in Derbyshire. As a token of esteem, his workmates at Markham Main have presented him with a wristlet watch."

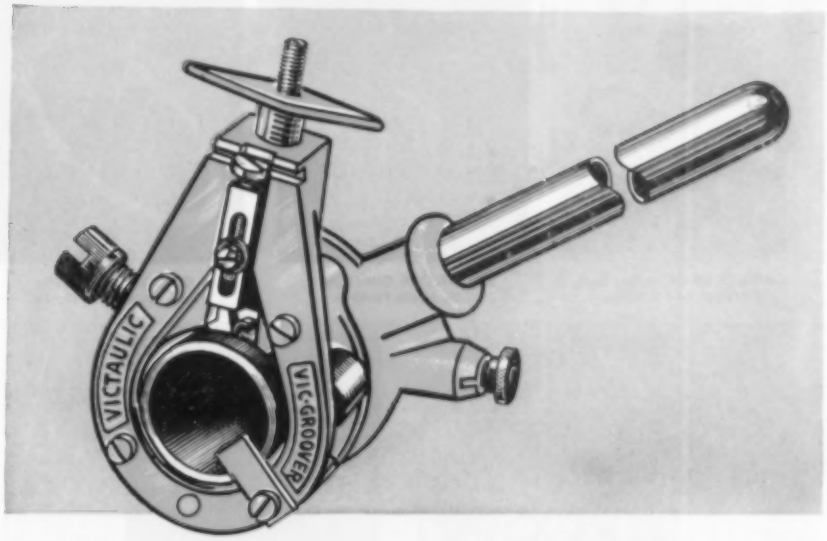
Iron & Coal Trades Review (London), January 16, 1953

Landmark Razed

A steel telephone tower in the heart of Stockholm, Sweden, was recently dismantled following damage sustained from fire in the telephone building on which it rested. Of its history, the Swedish-International Press Bureau writes:

"Built in 1887, the tower served as a giant crossarm, gathering all overhead wires from telephone subscribers in the city and also junction lines to satellite exchanges. The number of lines . . . increased year by year and eventually, according to a columnist, 'darkened the sky over Stockholm.' The tower remained as visual testimony to the great intensity of the telephone traffic . . . for 20 years until the overhead lines were gradually replaced by underground cables.

"Originally the tower had a somewhat truncated appearance but in order to appease public clamor for something more attractive, the structure was provided with four corner spires. Its prominent position made it a natural signal mast and it was frequently used to announce a variety of events. The hoisting of a yellow flag, for instance, was a signal that the 'Flying Baron,' one of Sweden's aviation pioneers, could take off, while a white flag with a big S mark announced that there were herring in plenty to be had at the fishmongers."



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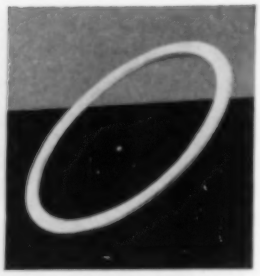
GARLOCK CHEVRON Hydraulic Packings



GARLOCK GUARDIAN Asbestos-metallic Gasket

GARLOCK KLOZURE Oil and Grease Seals for Bearings

GARLOCK LATTICE-BRAID Rod and Shaft Packings

BITAN*
CHEVRON*
GUARDIAN*
KLOZURE*
LATTICE-BRAID*

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PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

Books and Industrial Literature

Compressed Air Power in Industrial Production is the third in a series of engineering studies released by Compressed Air and Gas Institute and is intended to familiarize designers, engineers and production men in industry with pneumatic tools and facilities so they will be in a better position to evaluate them and install or design manufacturing equipment that will use air power to the best possible advantage. Applications are discussed comprehensively and include actuation by pneumatic cylinders, agitation of liquids, blast cleaning, chipping, scaling, clamping, drilling, forging, grinding, hoisting, molding, die casting, ramming, riveting, nut running, spraying and instrument control. The 36-page pamphlet contains 63 photographic illustrations and line drawings, together with thirteen tables that give valuable information on air consumption, number of tools that can be operated by compressors of varying sizes, etc. The book is punched for insertion in a standard 3-ring binder and can be obtained from Compressed Air and Gas Institute, 1410 Terminal Tower, Cleveland 13, Ohio. Price, twenty-five cents.

Machine Shop Tooling is the title of a 344-page handbook that was written for the man at the machine by Charles C. Williams and embodies data supplied by more than 50 cooperating manufacturers of tools and materials. Bound with an oil-resistant cover, the text matter is arranged in alphabetical order like a dictionary for easy reference and includes much original material, as well as a section on troubles with machine tools and materials and what to do about them. Published by Wilco Press, 3326 N. Bailey Street, Philadelphia 29, Pa. Price, $3.00.

The Commercial Intelligence Office, Oudebrugsteeg 16, Amsterdam-C, The Netherlands, issues a bulletin, *Buvoha Mededelingen*, every two weeks in which foreign firms may list products they desire to export and make inquiries concerning imports. It has a circulation of 5000 among industrial and commercial firms in Holland. Once each year the *Buvoha Trade Letter*, which lists Dutch firms looking for new business connections abroad, is distributed in all countries of the world. A copy of the latter may be obtained by writing to the Intelligence Office.

An improved model filing machine for die making that also saws and hones is the subject of a 4-page folder being distributed without cost by All American Tool & Mfg. Company, 8027 Lawndale, Skokie, Ill.

Pittsfield Products, Inc., 2275 Platt Road, Ann Arbor, Mich., is distributing a new catalogue dealing with its line of wire-cloth and perforated-metal screens, strainers and filters of a wide range of shapes and sizes.

Allis Chalmers Manufacturing Company, 1000 South Seventieth Street, Milwaukee, Wis., is offering a new bulletin (20B-6497A) on its Texrope grommet V-belt which is made without a splice and is said to give exceptionally long service.

Catalogue C2-4 now obtainable from Flexible Tubing Corporation, Guilford, Conn., describes its Spiratubes and Flexflyte (tubing less than 3 inches in diameter) for ventilating purposes, dust and fume removal, and materials handling.

Where to Use Coal Tar Protection is the title of an illustrated brochure released by

Tapecoat Company. It is based on years of experience in the field of combating corrosion and can be obtained from the company at 1523 Lyons Street, Evanston, Ill.

American Standards Testing Bureau, Inc., 44 Trinity Place, New York 6, N.Y., is distributing free of charge a new bulletin which lists 80 different methods of testing, inspecting and analyzing some 90 different kinds of products and describes the scope of its services in this field.

General Electric Company, Schenectady 5, N. Y., has released two bulletins on its Thy-mo-trol (thyratron motor control) drive. GEA-5829 describes a simplified drive for ¾- to 3-hp application and GEA-5827 a precision drive for ¾ to 10 hp. Copies are available upon request.

American Ventilating Hose Company has released an illustrated catalogue, No. 35, which contains installation and other pertinent data about its improved types of Flexaust—spiral wire-reinforced flexible hose for many applications. Get a copy by writing to the company at 100 Park Avenue, New York, N. Y.

In Bulletin 88-A the Niagara Machine & Tool Works, 637 Northland Avenue, Buffalo 11, N. Y., describes its 6-inch series all-steel bending rolls for forming cylinders, cones, rectangles and ovals from sheet steel. Literature shows how machines operate and lists capacities and special features for cutting grooves, etc.

Mead Specialties Company has released the 1953 edition of its Air Power Catalogue. The 56-page book is profusely illustrated and covers the firm's complete line of air-operated cylinders, chucks, presses, vises, valves, hammers and work feeders. Address requests for copies to Department P-13, 4114 North Knox Avenue, Chicago 41, Ill.

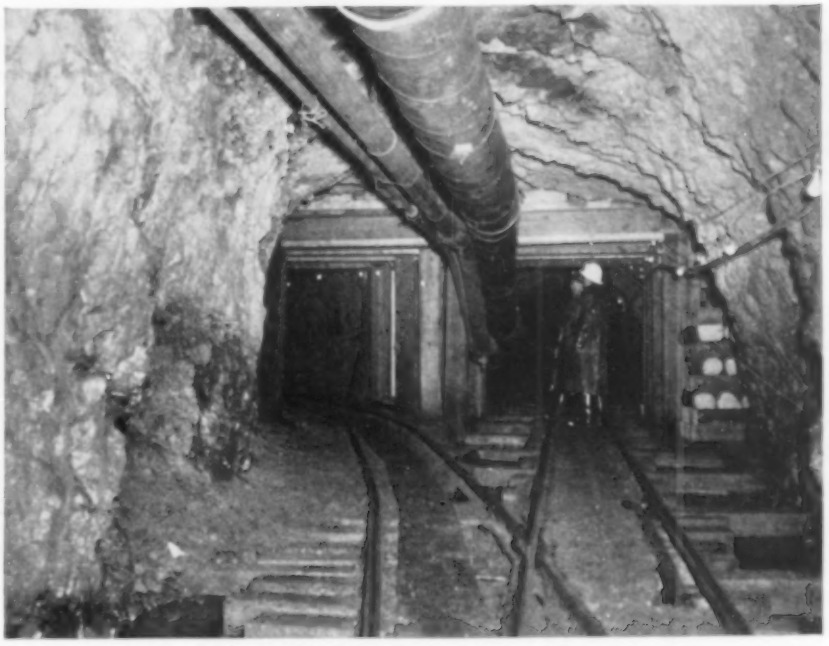
Ajax Engineering Corporation, Trenton, N. J., has issued an illustrated folder descriptive of its new combination induction holding furnace and pouring machine for die-casting aluminum and zinc alloys. Method of operation and characteristics of the unit, called Ajaxomatic, are dealt with, and an installation diagram is included. Copy will be sent free upon request.

Stucco Finishes Made with Pliolite S-5 is the title of a 16-page manual printed by Goodyear Tire & Rubber Company, Akron 16, Ohio. It deals comprehensively with the use of this thermoplastic resin as a vehicle in protective coatings for masonry, recommends grinding and finishing techniques, and lists applications. Requests for copies of the book should be addressed to the company's Chemical Division.

Bulletin 350 published by W.H. Nicholson & Company, 12 Oregon Street, Wilkes-Barre, Pa., describes its new Type D industrial steam trap. Smaller in size and capacity than other models, it embodies several improvements such as hexagon shanks of generous size to accommodate standard wrenches, rugged internal guide rod and tube, and a removable stainless-steel valve and seat. Copies of the bulletin can be obtained upon request.

Simplex Valve & Meter Company, Sixty-eighth and Upland Streets, Philadelphia 42, Pa., is offering a general catalogue on its measuring and control equipment for water and sewage works and power and processing industries. A 28-page book, it lists and describes many types of gauges, manometers, valves, venturi tubes, controllers etc., and contains data on mountings and operating characteristics. Ask for Catalogue 003.

with NAYLOR PIPE
YOU CAN PUT
Air where you need it



To bring in fresh air...to pull out fumes, gases and stale air...or to carry high pressure air, there's nothing like Naylor lightweight pipe in mining service.

Here's why. Naylor is built with an exclusive lock-seamed, spiralwelded structure which provides the extra strength, leaktightness and safety that permit you to use this light wall pipe in push-pull ventilating service and in high pressure lines. Naylor pipe is easy to handle and install. When used with the Naylor Wedge-Lock coupling, lines can be assembled quickly. Since the pipe can be coupled with only one side in the open, the line can hug the wall, thus saving valuable space.

For the full story, write for Bulletins No. 507 and No. 514.

NAYLOR PIPE COMPANY
1245 East 92nd Street, Chicago 19, Illinois
New York Office: 350 Madison Avenue, New York 17, New York

Eimco's Work Faster! Keep Job Costs Lower

Contractors, on all types of jobs, know that Eimco's will consistently save them money as an all around tool on general maintenance jobs, special repair jobs or new construction.

Take a job of loading sand or gravel. Eimco's will load from 4 to 6 yards per minute, and keep it up. This is a loading speed that invites comparison with heavier, more expensive equipment.

Eimco's are also good at digging unbroken ground for new roads, soil-silt deposits in riverbeds, taking up highway curb or shoulders, loading snow, clearing winter sluff, digging out frost blisters or digging ditches culverts or the toughest kind of rock loading.

Write for complete information on Eimcos stating your type of loading problem.

You Can't beat an Eimco

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The World's Largest Manufacturers of Underground Rock Loading Machines

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RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Now—two types of hose handle 95% of all air hose needs

Save days of waiting for special hose—save money, too

B. F. Goodrich makes an air hose for every purpose, but on the average two types of hose—Highflex and Type 50—are best for 95 to 99 out of every hundred air hose needs.

For general service—Type 50 is the most versatile hose made today. It's used for tie tamping, light and heavy portable compressors, air hoists, ore mining, quarry service and drills (left, above).

For hard-to-get-at-jobs where light weight and flexibility are so important, your best buy is Highflex. Weighing only half as much as ordinary air hose, Highflex is many times more flexible, making it easy to use in tight corners, easy to pull down a production line. Yet it has higher burst strength than heavy old-type hose of the same size. Especially designed for use with small shop tools (as shown at right, above), it's equally serviceable as welding hose, water hose, or even as a low pressure hydraulic hose.

Oil won't rot them—Both Type 50 and Highflex have tubes that won't break into loose, gummy particles to clog up tools. Their covers are oil-resisting, too. Can be dragged through oil or grease without damage.

Rough treatment won't tear them—Both types of hose have abrasion-resistant covers. Scraping over rock, rough floors, cinders or roads won't tear them. Won't check or crack from constant sunlight.

Saves waiting—B. F. Goodrich distributors have both Type 50 and Highflex for immediate delivery. Now there's no need to hold up production while waiting for special kinds of hose. For quick delivery the next time you need air hose, call your local BFG distributor or write *The B. F. Goodrich Company, Industrial & General Products Division, Akron, Ohio.*

Air Hose BY **B.F.Goodrich**

Air hose with cover and tube of NEOPRENE gives dependable service in ship construction

It takes a rugged man to handle an impact wrench in a shipyard—and a rugged hose to supply compressed air for the job. The hose here is subjected to constant flexing and the roughest kind of abrasive conditions (as pictured above). It is dragged over sharp metal edges, pulled around corners, and scuffed and scraped by obstructions of all kinds . . . while inside the tube is hot, oil-laden air. Yet here's an air hose that can take the most punishing treatment. It's made inside and out with neoprene.

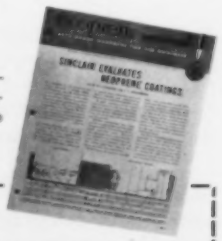
THE COVER OF NEOPRENE is tough and durable . . . resists abrasion, cutting and chipping throughout its long life. And, because neoprene can withstand the deteriorating effects of sunlight, heat and weathering, the fabric reinforcement receives maximum protection.

THE NEOPRENE TUBE won't go to pieces when exposed to hot lubricating oil in the air stream. No crumbled particles are carried along to clog vital tool parts. And neoprene's toughness and flexibility assure long, trouble-free service under the most adverse conditions.

DU PONT SUPPLIES neoprene to air hose manufacturers who use it in their top-quality lines. Ask your supplier about hose with cover and tube of neoprene. He'll be glad to show you how it's built for rugged service.

***FREE!* The Neoprene Notebook**

Each issue brings you new, unusual applications of neoprene . . . new products . . . interesting stories. Send in the coupon below to get on the mailing list.



E. I. du Pont de Nemours & Co. (Inc.)
Rubber Chemicals Division Y-4
Wilmington 98, Delaware

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NEOPRENE

The Rubber Made by Du Pont Since 1932

DU PONT

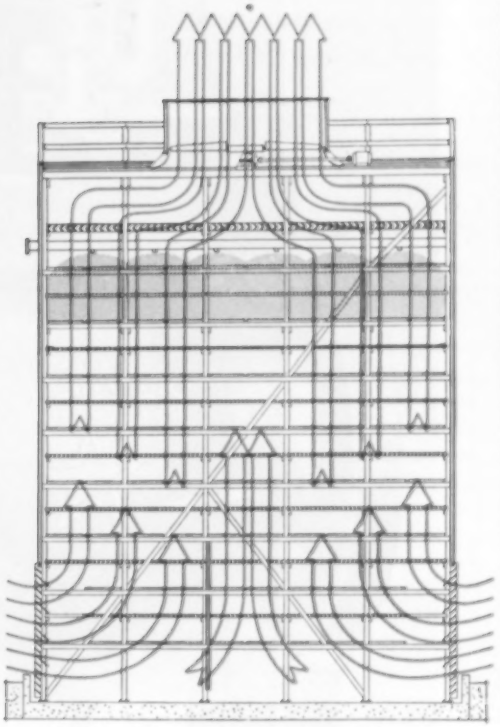
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

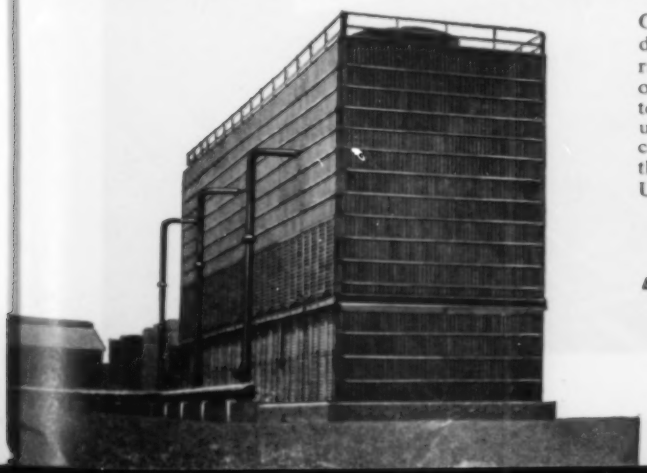
Efficiency of FLUOR COUNTERFLO Cooling Towers begins at the top

Heavy stainless steel fan blades are finely balanced, resist corrosion and are mounted on shafts whose exceptionally high fatigue strength has been substantiated by strain gauge tests and actual use. Pitch is adjustable to efficiently handle required air volumes at minimum tip speeds and horsepower requirements – more air per kilowatt. Speed reducers incorporating spiral bevel gears feature oil-bath lubrication and dry-air breather. The low-speed fan shaft is mounted on special steep angle thrust with radial bearings to take the combined gear thrust, fan thrust and weight of fan assembly. Driving mechanisms are built for hard-wearing, maintenance-free performance and for smooth, quiet operation.

Vibration Cut-out switches, exclusive with Fluor Cooling Towers, are an emergency safety device that stops the motor should excessive vibration accidentally occur, preventing possible damage to the tower or mechanical equipment. Design employing internal gusset plates duplicates that used in wooden bridge construction. These connectors add greater tensile and compressive strength to structural members, lower the total weight of towers, require less erection time and materially increase tower life. Sloping grid decks of rough-finished redwood with minimum one-inch dimension are used as scaffolding during erection and provide maximum deck surface with negligible air pressure drop through the tower.



Air distribution is controlled at every stage of its travel through the tower. Louver height is designed to obtain the desired intake velocity and wind-deflectors inside the tower uniformly direct air currents to all areas. Approach to the desired wet-bulb temperature is easily accomplished and performance to customer's specifications is guaranteed in every case.



Only Fluor Counterflo Cooling Towers are completely prefabricated. All cutting, drilling, and nailing is performed at the factory and tower parts are "packaged" for rapid delivery, marked for orderly assembly. More efficient control of the quality of straight-grained heart of California redwood and excellent workmanship in Fluor towers are maintained through prefabrication. Inexperienced craftsmen and laborers under Fluor's supervision can erect a Fluor tower in a minimum of time and at considerable savings in erection costs. Prefabrication means standardization; parts that may become worn or damaged over the years may be replaced economically Uniformity of appearance as well as performance is assured.

BE SURE WITH **FLUOR**

THE FLUOR CORPORATION, LTD.
LOS ANGELES 22, CALIFORNIA

FOREIGN: FACTS-FLUOR-PARIS
FLUOR OF CANADA-TORONTO
FLUOR INTERNATIONAL-BEIRUT
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ENGINEERS
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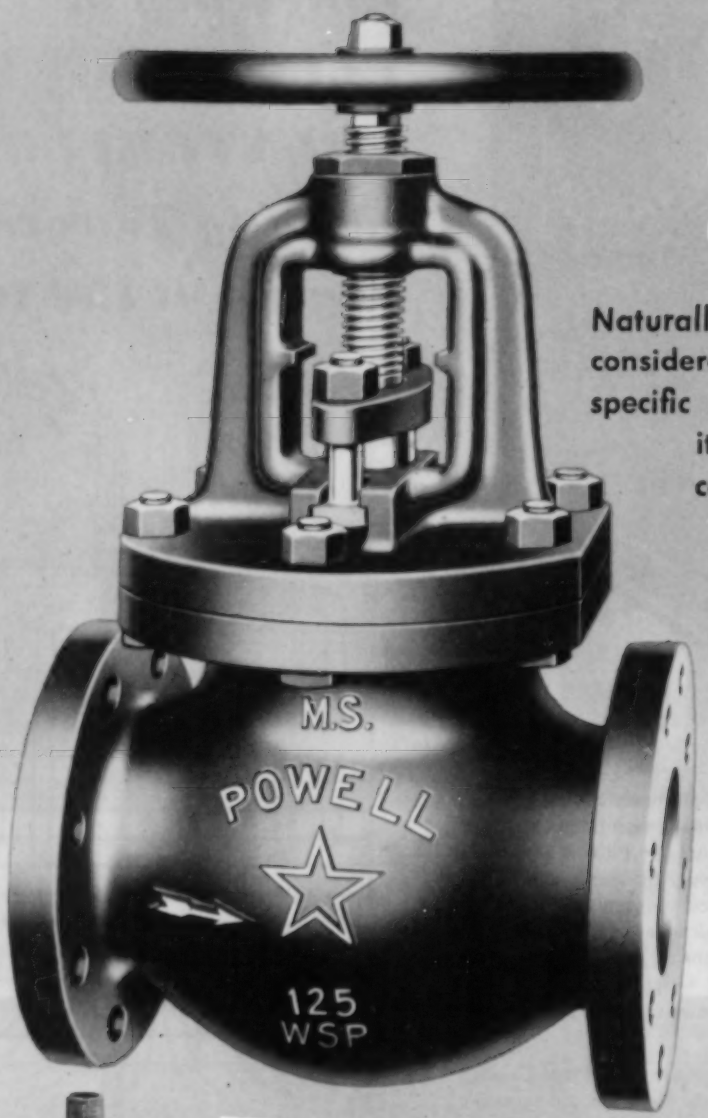


The name "POWELL" on a valve assures absolute dependability

Naturally, in buying a valve, the first consideration is its ability to perform a specific service. But that is not all. For it must also be a valve that will continue to function dependably for a long time. Powell Valves have an established reputation for absolute dependability.

The Wm. Powell Co.
Cincinnati 22, Ohio

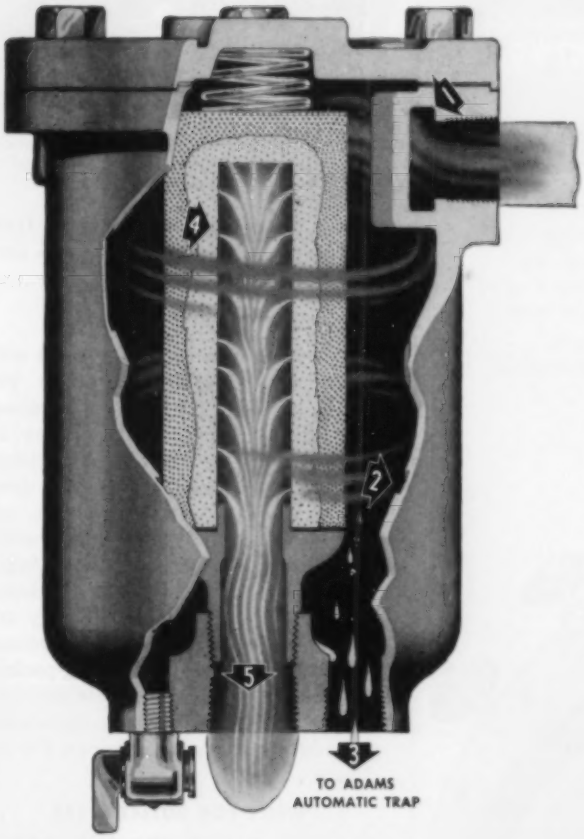
Fig. 301—125-pound Iron Body Bronze Mounted Globe Valve. Has flanged ends, bolted flanged yoke, outside screw stem, renewable bronze seat and disc holder with renewable composition disc.

DEPENDABLE VALVES SINCE 1846

POWELL

BRONZE, IRON, STEEL AND CORROSION RESISTING VALVES

ADAMS *has both* *



—— BOTH ANSWERS TO THE PROBLEM OF KEEPING WATER, WATER VAPOR, OIL AND DIRT OUT OF COMPRESSED AIR LINES

There's no *one* answer to this problem! The most expensive aftercooler you can buy will not remove scale that is picked up in the distribution lines. The most expensive air filter you can buy cannot guarantee removal of water vapor until it has been condensed by cooling. That's why Adams makes both.

* PORO-STONE *AIR FILTER*

1. Centrifugal separation of dirt and liquids.
2. Drainage to trap directed by vertical cast-in slots.
3. Continuous, fully automatic trap action.
4. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
5. Clean, dry air at practically unchanged pressure. Standard, stocked sizes handle from 10 to 700 cfm.

Easily installed in either vertical or horizontal pipe line.

* AFTERCOOLER AND CYCLONE SEPARATOR

Cools air to within a few degrees of cooling water, making certain that compressed air is colder than surrounding atmosphere, so that no further condensation can take place.

Counter flow, air-through-tube design assures continuously high heat transfer rate.

Double cyclonic action deposits all water and entrained oil in moisture chamber.

R. P. ADAMS CO., INC.
209 E. Park Drive, Buffalo 17, New York

Please send me your latest literature, Bulletin No. 176 on BOTH the Poro-Stone air filter and the Adams Aftercooler — Cyclone Separator.

Name.....

Company..... *Title*.....

Address.....

City..... *State*.....

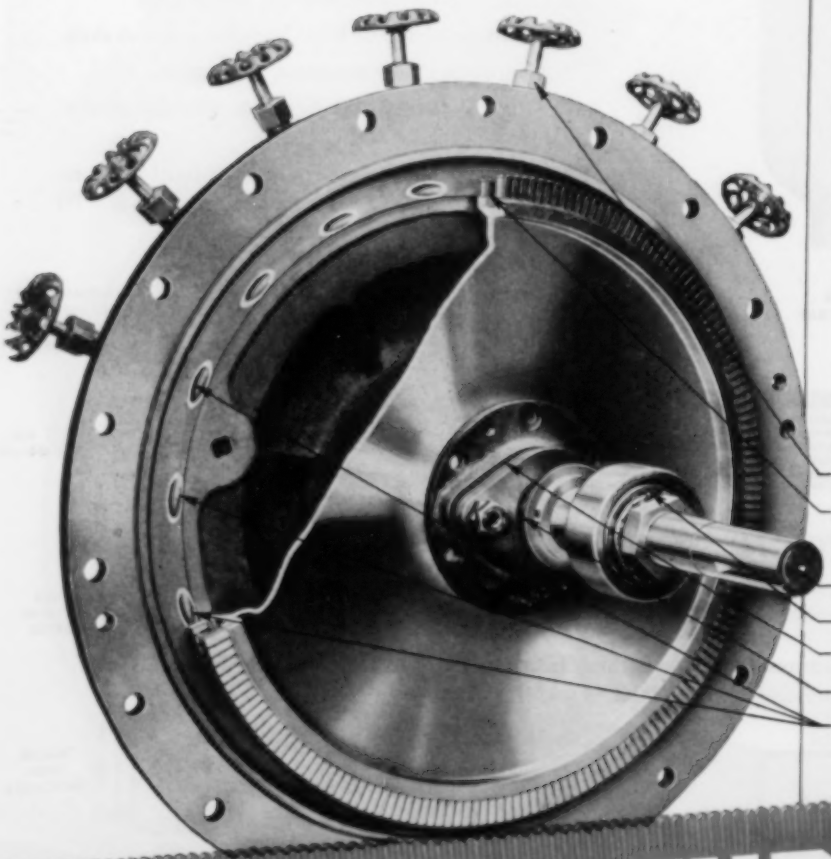
FOR YOUR PROFIT'S SAKE — FIND OUT ABOUT BOTH

R. P. ADAMS CO., INC., BUFFALO 17, N. Y.

No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



- 7 hand valves for efficient partial load operation, (20" turbine shown)
- 2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced
- 30-40 carbon steel shaft
- Oversized double row deep grooved ball bearing
- Stuffing box with metallic packing ring
- Heavy chrome plating of shaft through stuffing box
- 3 nozzles always open

Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

WRITE FOR BULLETIN 135

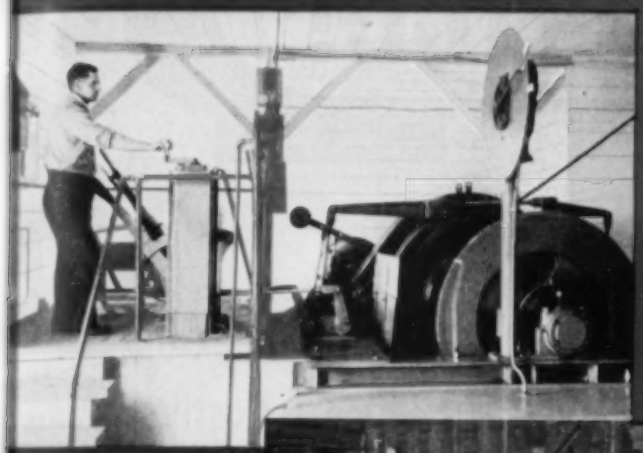
COPPUS ENGINEERING CORP.,
204 Park Avenue, Worcester 2, Mass.
Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

ELECTRIC MINE HOISTS

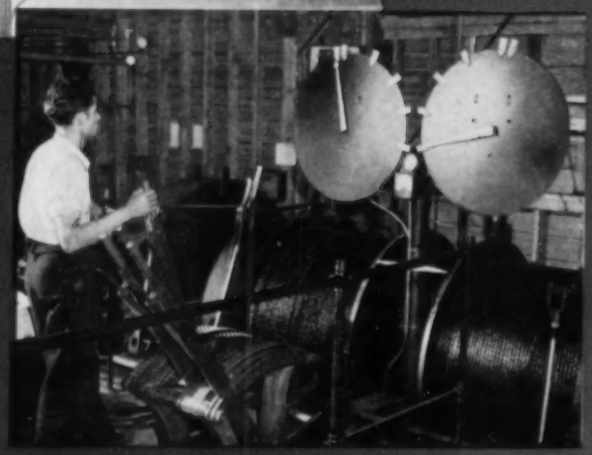
...by Canadian Ingersoll-Rand

. . . including a complete range of smaller units for shaft sinking, development and production.



Wherever you go, you find these sturdy smaller hoists at work. Like the larger hoists made by Canadian Ingersoll-Rand, every one of these smaller hoists is designed to meet a set of special requirements. This fact, plus Ingersoll-Rand's unique record of hoist engineering experience adds up to the safe, dependable hoist service famous among mining men all over Canada.

Call an Ingersoll-Rand man when you want to talk about hoists.



SOME FACTS ABOUT THESE SMALLER I-R HOISTS:

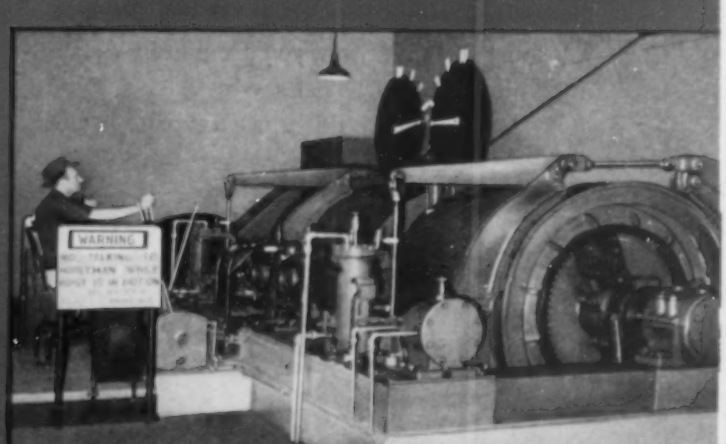
- *available in 30-inch to 60-inch drum diameters*
- *rope pulls of 5,000 to 14,000 pounds*
- *single or double drum machines with drum(s) keyed or clutched*
- *post-type main brakes on each drum with choice of brake lining material*
- *brakes and clutches operated by direct hand lever or fitted with either air or oil engine control*
- *brakes and clutches interlocked*
- *drums either plain or grooved*
- *gear-driven depth indicators*

Canadian Ingersoll-Rand Company Limited

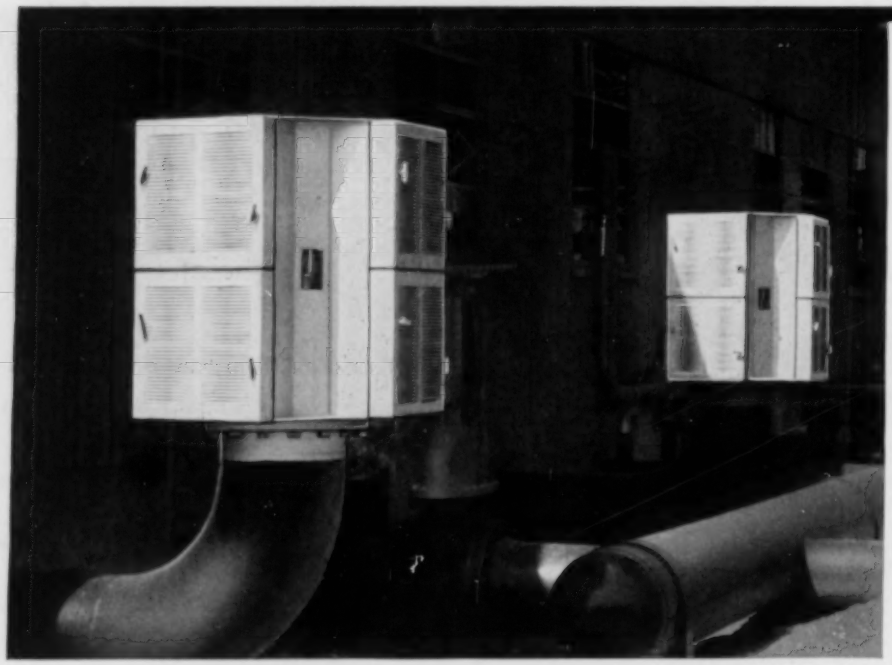
HEAD OFFICE - MONTREAL, QUE. WORKS - SHERBROOKE, QUE.

CANADA

OVER 60 YEARS OF EXPERIENCE BUILT INTO EVERY HOIST



GUARD THE INTAKE and CUT YOUR OUTGO!*



*AAF "OC-H" Filters Eliminate Costly Repairs and Time Losses Due to Dust Damage

You're actually "piping trouble" to your engines and compressors when you fail to properly filter the air at the intake. The result is always the same—always costly—major repairs accompanied by important production losses.

Nor does the presence of just any filter at the intake guarantee protection. If it's doing a job short of perfection, you are merely delaying your troubles. That's why AAF's Type "OC-H" Air Intake Filter is a favorite in the field. This washable unit-type filter combines high cleaning efficiency with low resistance to air flow and large dust holding capacity. Its first cost is low, and sturdy construction assures long, trouble-free operation.

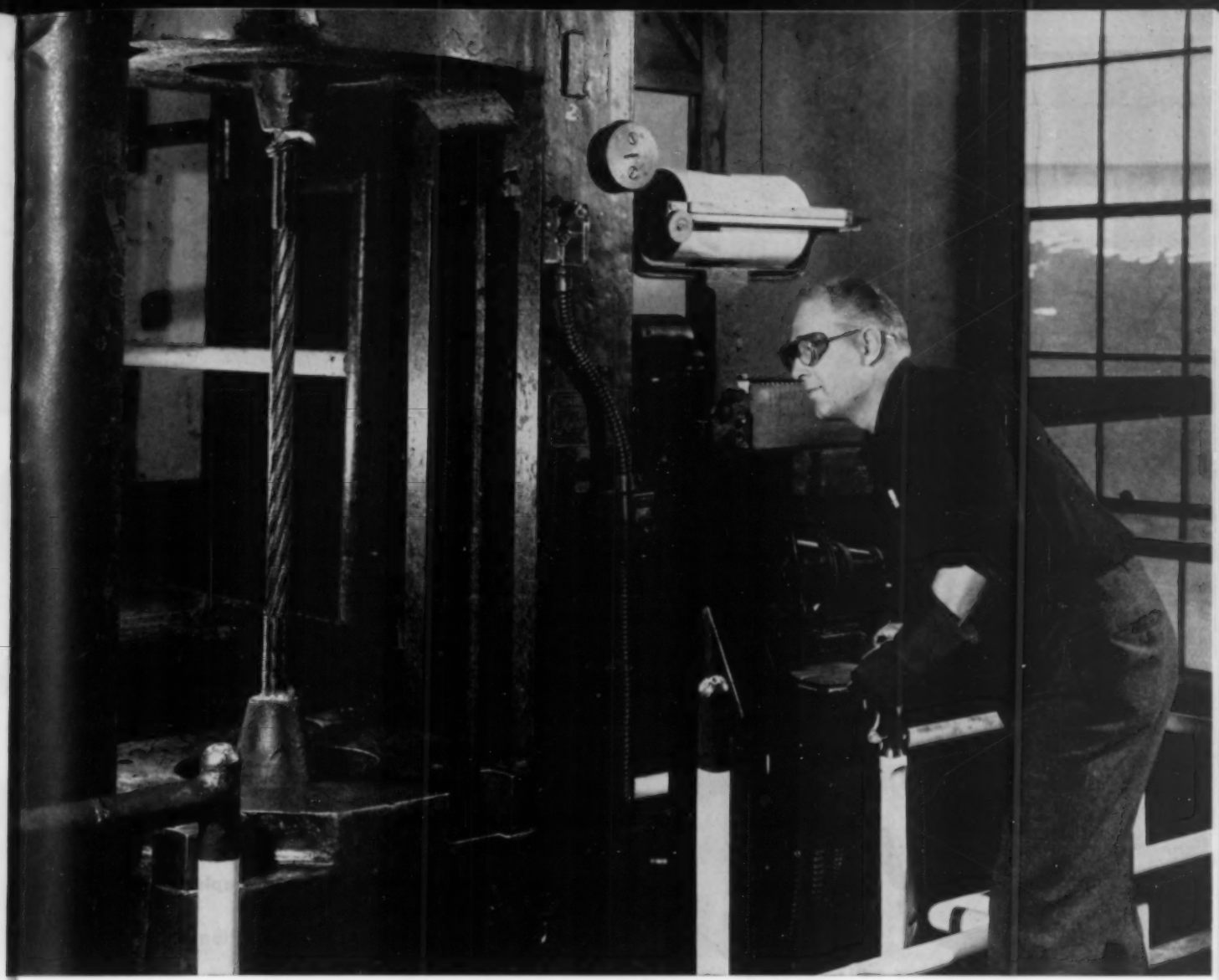
Don't let "dust protection" be an afterthought in your planning. AAF's complete line of Air Intake Filters permits the selection of the most economical and efficient unit for handling your specific dust loads. Write us today for complete catalog information.

AAF

American Air Filter

COMPANY INC.

402 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.



The rope won't suffer long. First the stretch, then the "bang" as it breaks. Tough on the rope—but it gives us vital information!

Check and test . . . check and test

In the making of Bethlehem wire rope, quality control is a fundamental point. It is a factor as basic as proper design; it is the core, the heart, of our careful manufacturing methods.

Throughout this program of quality control, many different tests are employed, for no single test will suffice. The one shown here is an excellent example —one that is cruel to the rope but that yields vital facts.

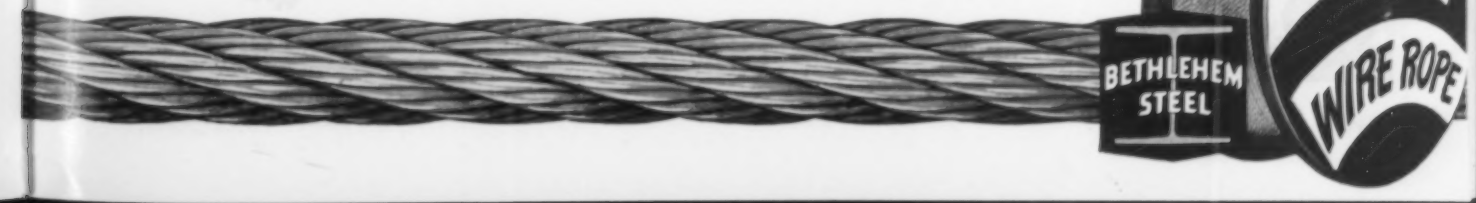
Offhand, you wouldn't think that any machine could possibly break that big, stout Bethlehem rope. It is made of tremendously strong steel wires, and it will lift or support many tons. Yet the machine pictured can break the rope in a matter of seconds. Object: to establish the ultimate tensile strength of the rope.

This rigorous treatment is all part of our overall formula. From open hearth to finished rope, it's check and test, check and test. Nothing is left to chance. Because of this attention to detail, you can depend upon Bethlehem rope to do the job expected.

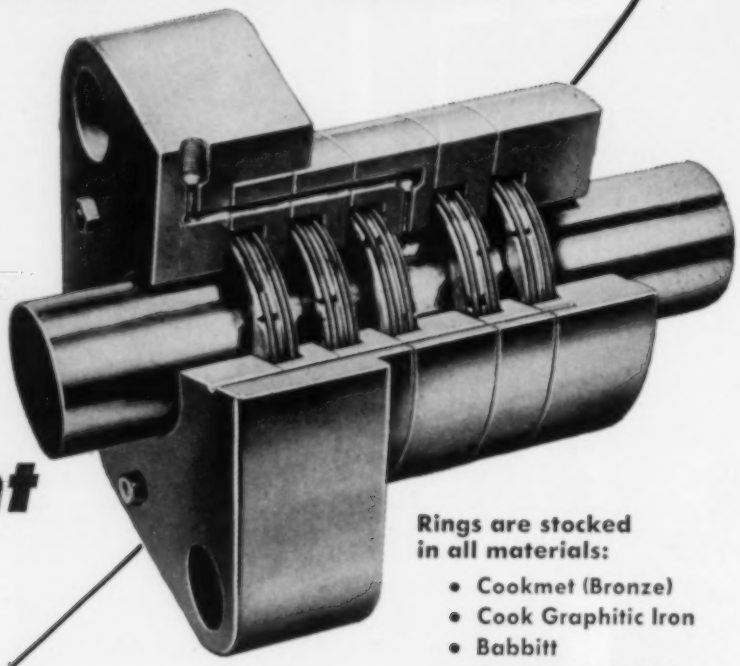
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

When you think WIRE ROPE . . . think BETHLEHEM



CALL COOK



. . . for fast service on packing replacement parts!

Rings are stocked in all materials:

- Cookmet (Bronze)
- Cook Graphitic Iron
- Babbitt
- Cookroc (Bakelite)

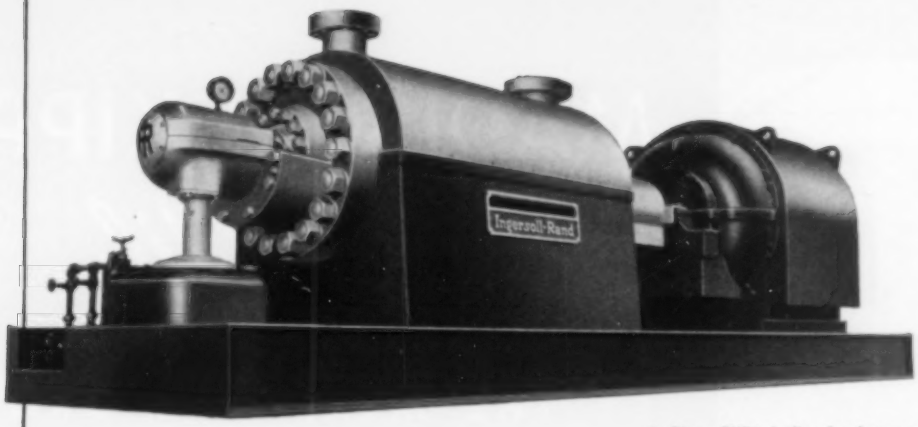
WHEN WEARING RINGS REQUIRE REPLACEMENT, you generally need them in a hurry. That's why it will pay you to call COOK whenever the occasion arises. Our warehouses are located at strategic points throughout the country and are stocked and ready to give your orders fast, efficient attention. Emergency shipments of Bronze, Cook Graphitic Iron, Babbitt or Cookroc (bakelite) rings can usually be made within a few hours' time. So, don't take chances with substitutes . . . always insist on genuine COOK packing parts. You'll get them just as fast as they can possibly be delivered.

C. Lee Cook Mfg. Co., Incorporated, Louisville, Ky. Branch offices in Baltimore, Boston, Chicago, Cleveland, Houston, Los Angeles, Mobile, New Orleans, New York, San Francisco and Tulsa.

COOK

ROD PACKINGS

SEALING PRESSURES SINCE 1888



A Class CHTA boiler-feed pump

"The common and indiscriminate use of the word BEST has caused it

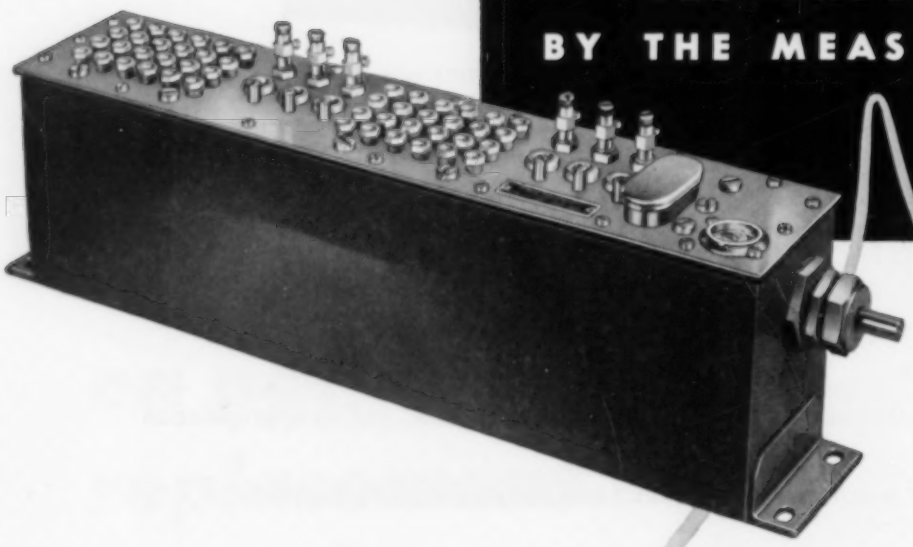
to become hackneyed and shorn of its value, and its appropriation is sometimes unwarranted and not endorsed by the public. Yet the producer must have the courage of his convictions with reference to his product, and fail not to speak boldly and openly of it. There is but one CAMERON; it is not of mushroom growth, but has stood the test of use for over fifty years in every clime and under all conditions; it challenges criticism, invites comparison, and commands respect by deserving it, and welcomes every opportunity to be tested."

quoted from the Cameron pump catalog published in 1910

INGERSOLL-RAND COMPANY • CAMERON PUMP DIVISION
11 Broadway, New York 4, N. Y.

MADISON-KIPP *Fresh Oil*

. . . FED UNDER PRESSURE BY THE MEASURED DROP



the most dependable method of lubrication ever developed!

This lubricator becomes an integral part of a machine tool in which there are 48 vital bearings that require dependable lubrication. The Madison-Kipp mechanism is so compact that the reservoir measurements are only 4" wide, 19¾" long by 5¾ high."

There are six different models to meet almost every application requirement. Please write us for all details regarding your particular lubricator requirements.

MADISON-KIPP CORPORATION
202 WAUBESA STREET • MADISON 10, WISCONSIN

kipp

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

GM DIESEL CASE HISTORY No. 516-2

USER: Mancini-Miller-Thompsen Co., East Detroit, Michigan

INSTALLATION: GM 6-71 Diesel, powering an Ingersoll-Rand Gyroflow 600 cfm compressor, which supplies air to a McKierman-Terry 9B3 double-action hammer.

PERFORMANCE: GM Diesel engine in this compressor does the work of two engines powering 500 cfm compressors formerly needed to drive hammer. Fuel costs are halved. GM Diesel saves 15 minutes starting time.

THIS DIESEL TAKES THE PLACE OF TWO

and cuts costs in half

Here's another application where the compactness and high-speed power of General Motors 2-cycle Diesel engines save money for contractors. With power on every piston downstroke, instead of every second downstroke as in 4-cycle engines, a GM Diesel delivers plenty of smooth, steady power. It gets more work done in less time because it accelerates faster. It starts at the push of a button and is easy to operate and maintain. Compactness of this power-packed engine enables it to fit in about the same space as gasoline engines of comparable power—providing savings of 40% to 70% on fuel and maintenance. See your GM Diesel distributor or write us for full information.

It pays to Standardize on

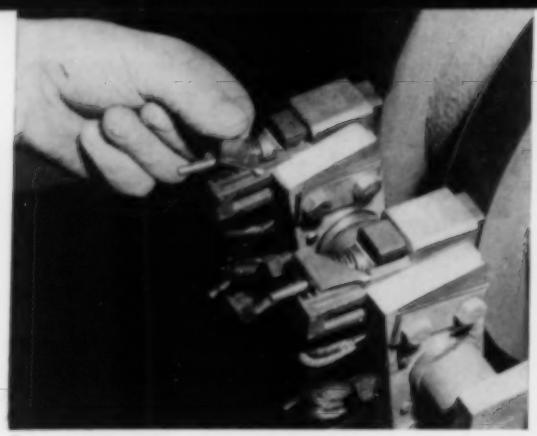
GM GENERAL MOTORS DIESEL POWER

Write for booklet "A 50,000,000 Horsepower Insurance Policy" that tells you why.

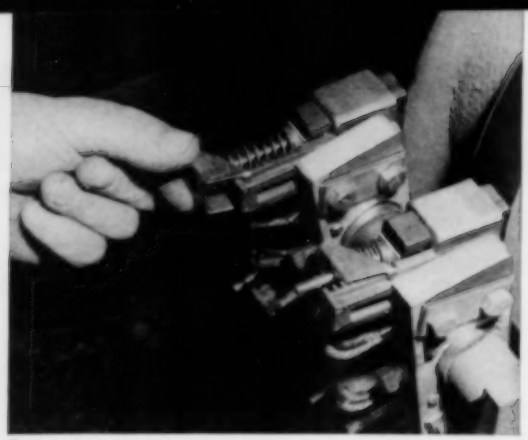
DETROIT DIESEL ENGINE DIVISION

GENERAL MOTORS • DETROIT 28, MICHIGAN

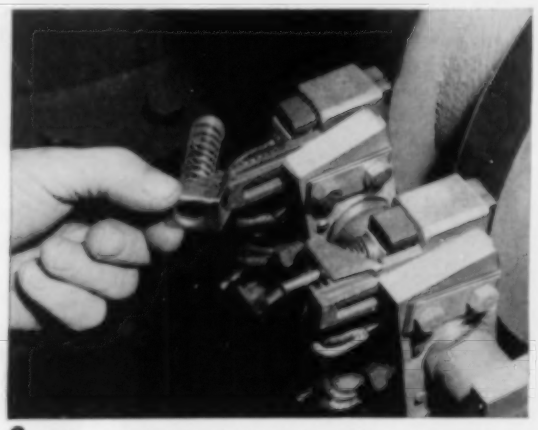
SINGLE ENGINES . . . Up to 275 H.P. MULTIPLE UNITS . . . Up to 800 H.P.



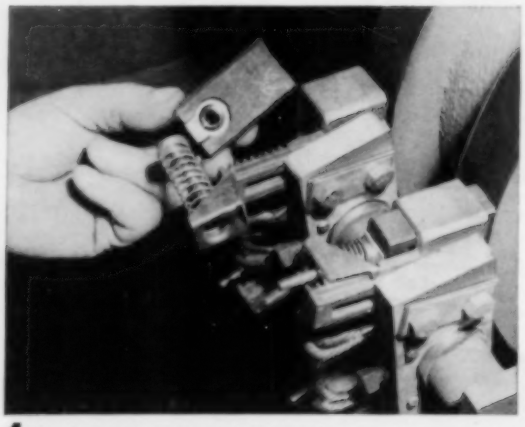
1 To reset brush tension, operator releases spring lock . . .



2 slides it back to relieve pressure . . .



3 and swings locking device to one side . . .

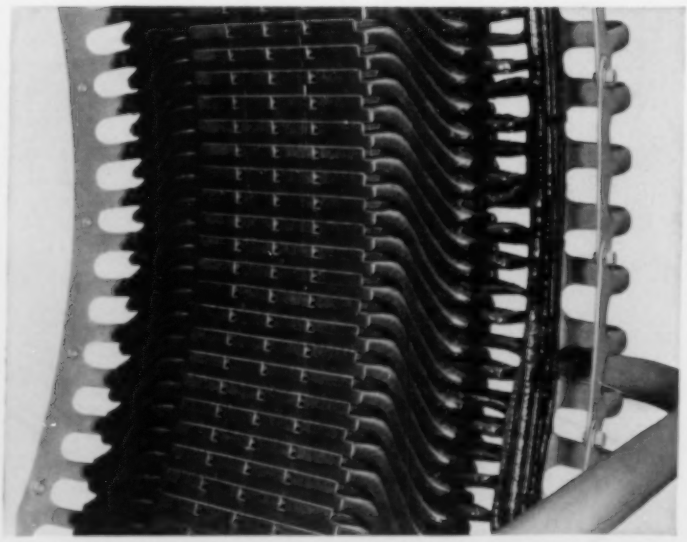


4 for fast and easy brush removal.

BRUSH-PRESSURE ADJUSTMENT, for maximum brush life, and replacement, to assure reliable motor service, are simple matters on G-E synchronous motors. A calibrated spring-loaded brush holder makes resetting brush tension or removal of brushes fast and easy. Brushes are staggered for even brush-ring wear.

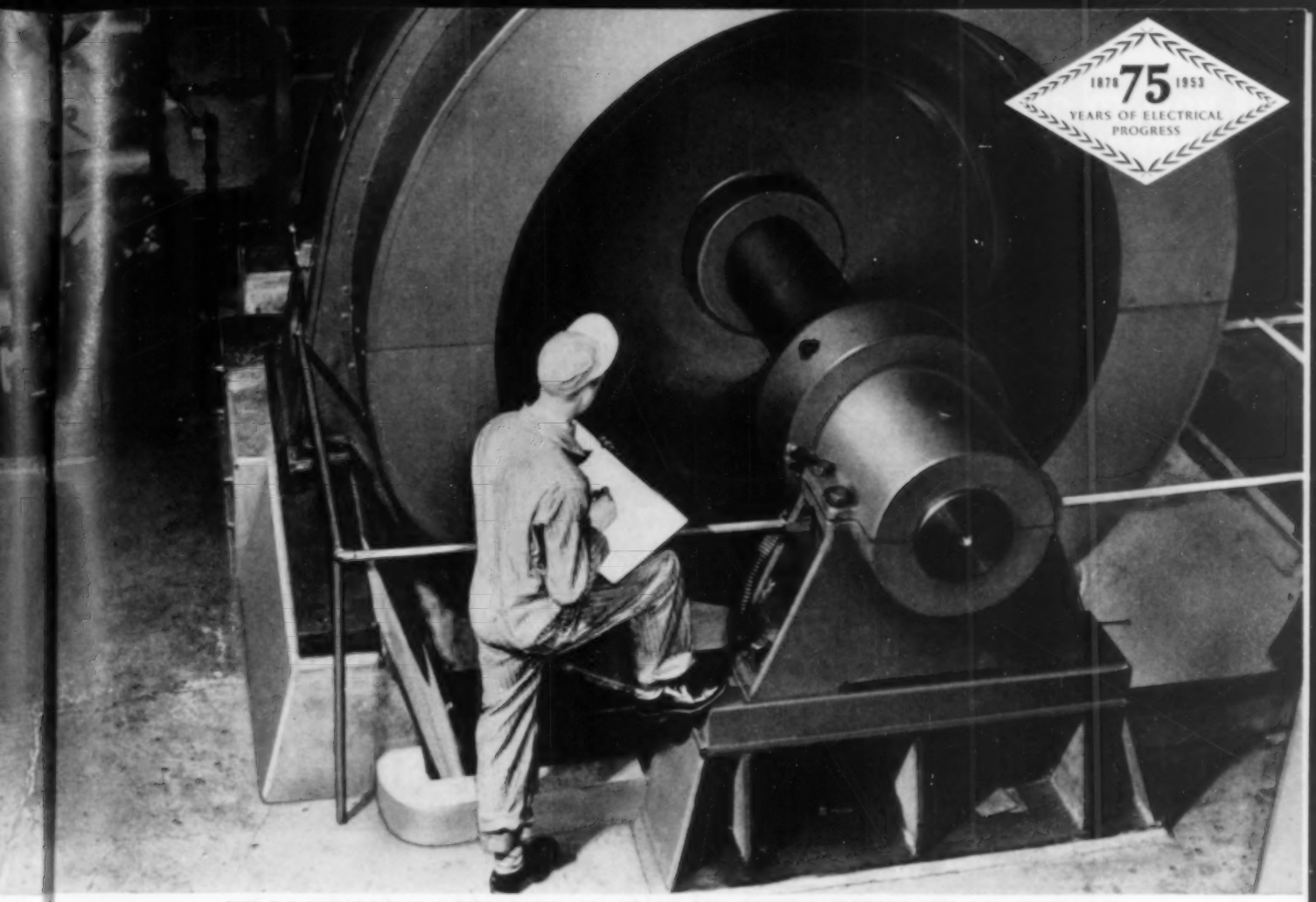
See How Routine Maintenance Is

BEARING LUBRICATION can be readily checked through a large sight-level gage on the bearing pedestal; and when oil is required, handy snap-top covers are provided for easy refilling, as well as oil-ring inspection. A drain plug is conveniently located for quick oil changes.



INSULATION CLEANING is fast on G-E synchronous motors. Windings are coated with a high-gloss Glyptal* varnish that resists the accumulation of dust and can be vacuum or air cleaned in most applications. In extremely dusty or oily atmospheres, deposits can be easily wiped from the windings. Clean windings mean longer insulation and machine life.

*Reg. trademark of General Electric Co.



THIS G-E SYNCHRONOUS MOTOR, RATED 4500 HP, 300 RPM, DRIVES A RECIPROCATING GAS COMPRESSOR.

Easier on G-E Synchronous Motors!

Routine maintenance involves three factors: brushes, lubrication, and insulation. To be sure that these areas are properly serviced, G-E synchronous motors have design features that make checking easy and maintenance fast. Close at hand and easy to adjust, the brush-rigging construction encourages your maintenance men to inspect regularly. Oil-level gage and inspection caps are arranged for quick checking and filling when necessary. The high-gloss insulation on G-E synchronous motor windings resists the adhesion of dust and minimizes the need for cleaning.

These features promote long, reliable motor service and save valuable time for your maintenance crews.

Before selecting your next heavy-duty motor, be sure to consider these important maintenance features. Call in your G-E representative. He will be glad to discuss the many money-saving applications for G-E synchronous motors. Meanwhile, you can obtain more information on G-E synchronous motors by requesting the following publications: GEA-5332, "Low-speed Synchronous Motors" or GEA-5426, "High-speed Synchronous Motors." Write to Section 770-28, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

HOW TO GET BETTER COMPRESSED AIR DRAINAGE!

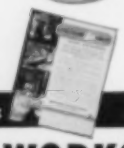
USE THE RIGHT TYPE TRAP FOR THE JOB!

TYPE OF TRAP	SNAP ACTION (Fig. 1)	REGULAR BALL FLOAT (Fig. 2)	INVERTED BUCKET (Fig. 3)
Handles oil?	Light oil only	No	Very well
Handles dirt?	Moderate	No	Very well
Air loss?	None	None	Small
Requires priming?	No	No	Yes
Float collapse or leakage?	Remote	Remote	Impossible
Gravity drainage to trap required?	Yes	Yes	No

FIG. 1

FIG. 2

FIG. 3



GET THE FACTS:

FREE AIR TRAP BULLETIN *Send Today*

ARMSTRONG MACHINE WORKS

885 Maple Street, Three Rivers, Mich.

DE ZURIK VALVES • • • RIGHT AT HOME IN PIT AND QUARRY!

The leak-free performance of De-Zurik EASY-OPERATING PLUG VALVES has a great proving ground right next door in Minnesota's famed granite quarries.

Old-time quarry-men will tell you: Air-line losses and valving troubles disappear when DeZurik Valves are installed. They handle other services, too — all with air-tight efficiency, without friction, binding or lubrication. Write for data.

DEZURIK SHOWER CO.

SARTELL, MINN.

TWO HANDY REFERENCE BOOKS

For

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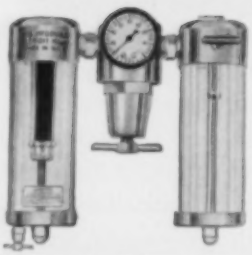

The value of "M-B" Automatic Air Line Filters, Regulators and Lubricators is widely known for their effectiveness as a protection to Air Valves, Cylinders, Pneumatic Tools, etc.

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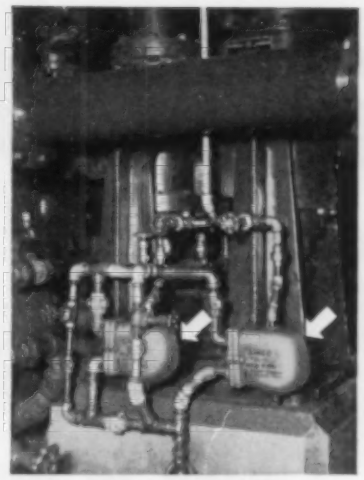
Remove Water from Compressed Air with Sarco Drain Traps

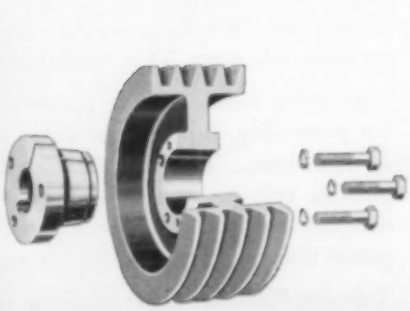


Water accumulating in compressed air systems must be drained off promptly to prevent damage to tools, marred paint surfaces or wetting of material to be cleaned—especially electrical machines.

Sarco Drain Traps should be installed at the aftercoolers (as in our illustration) on separators, at the receiver, and on low points in the lines, to remove all water as it accumulates.

These traps are available for pressures to 750 psi. Operate automatically without waste of air. Technical Bulletin No. 5 will help you get more work from your air compressors at less cost. Write for it to *Sarco Company, Inc., Empire State Bldg., New York 1, N. Y.*

Advt. 615



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More and more manufacturers are using this hub and rim combination. They know that taking off or putting on ordinary sheaves takes a lot of time and trouble, resulting in unnecessary machine down-time.

Wood's "Sure-Grip" Sheaves with interchangeable, one-piece tapered hubs (split from end to end) permit you to change the hub quickly and easily to fit shaft size, or to change the sheave to provide different speed. Dimensions are standardized for interchangeability, in A, B, C, D and E groove sections. Write for our descriptive catalog 192 and consult your Wood's Industrial Distributor.

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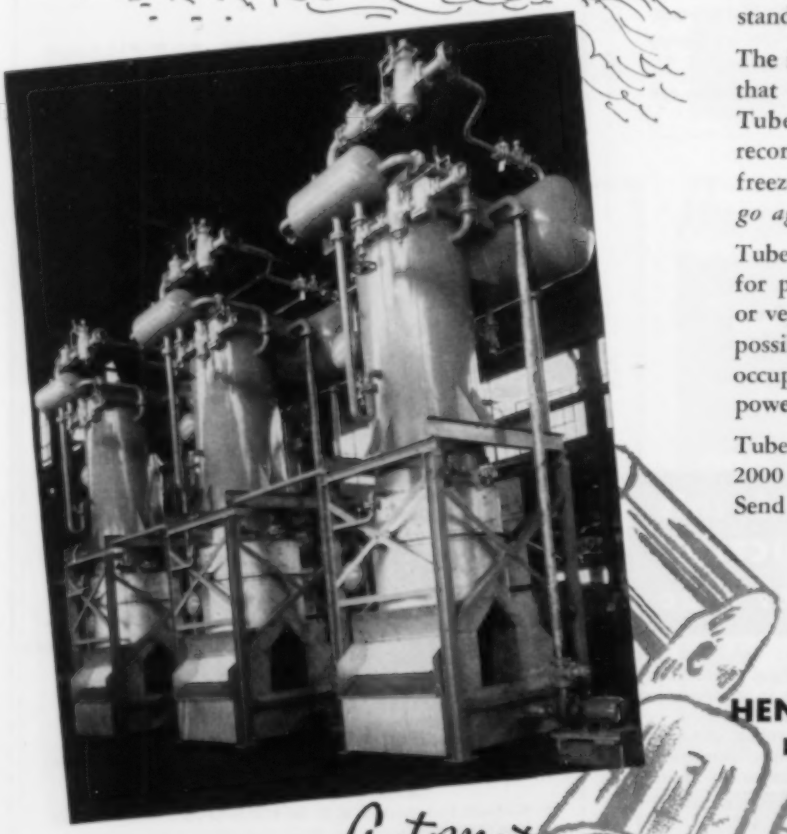
186,072,500 pounds of Tube-Ice used in building 2 WESTERN DAMS*



Yes—that much ice was required to cool the concrete mix in order that it set properly to develop its ultimate strength for two outstanding dam structures.

The important part of this message to you is that the compact and readily portable Vogt Tube-Ice Machines pictured here set this record without even the replacement of a freezer tube. What's more, they are *ready to go again* whenever ice is needed in quantity.

Tube-Ice is widely used in process work and for preserving shipments of meat, fish, milk or vegetables... and is produced at the lowest possible cost per ton since a Tube-Ice unit occupies less space, has fewer parts, uses less power than any other method for making ice.

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**McNary Dam, Washington, and Pine Flats Dam, California, required a total of 2,730,000 cu. yds. of ice cooled concrete mix.*

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Prevents tie-ups on costly stamping dies

...with help of TIMKEN® bearings

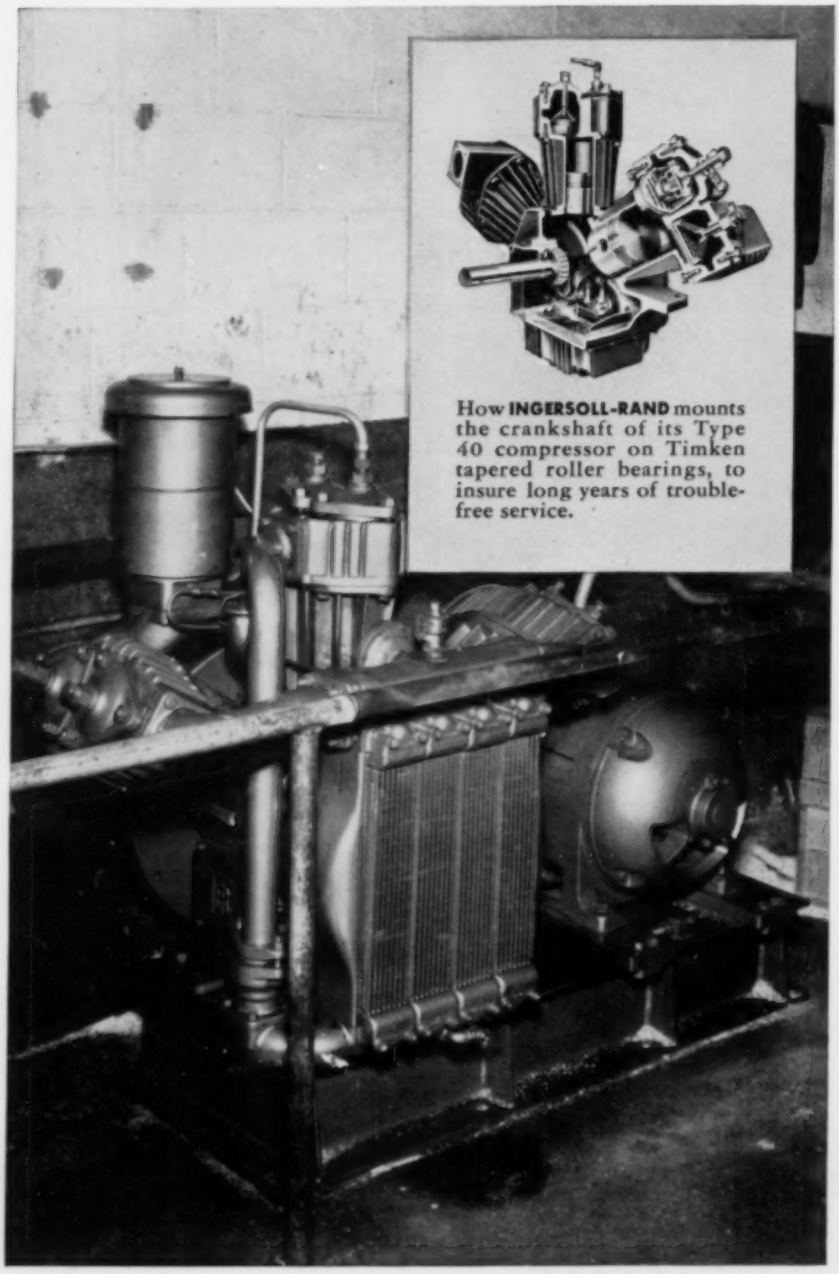
Cutlery Corporation of America refuses to let wasted time between stampings hold up production. At their Bridgeport, Conn., plant, they clear stampings off the dies with blasts of compressed air, supplied by an Ingersoll-Rand Type 40 compressor.

For an installation like this, where a "down" compressor would actually slow stamping production, this was a sound choice. For one thing, the crankshaft turns on Timken® bearings. Their precision and tapered roller design hold the crankshaft in rigid and accurate alignment. This, of course, saves wear on piston rods, wrist pins and related parts, and helps to eliminate downtime.

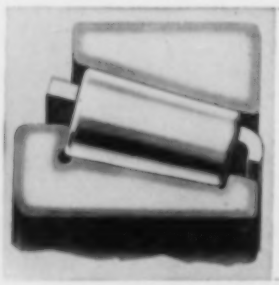
Another maintenance saver: lubricant stays in Timken bearings, while dirt and dust stay out. The bearings hold housings and shaft concentric, making closures more effective. And, because Timken tapered roller bearings handle radial and thrust loads alike, no extra thrust bearings are needed.

Timken bearings normally last as long as the compressor they're installed in—as many thousands of Ingersoll-Rand compressor owners will tell you. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **INGERSOLL-RAND** mounts the crankshaft of its Type 40 compressor on Timken tapered roller bearings, to insure long years of trouble-free service.



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Rollers and races of Timken bearings are case-carburized to give a hard, wear-resisting surface and a tough, shock-resisting core. Result: longer bearing life.

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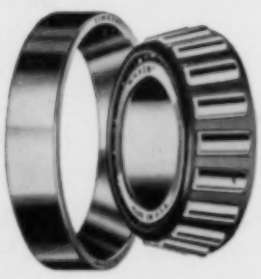
TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ↓ AND THRUST →▯← LOADS OR ANY COMBINATION →✳←